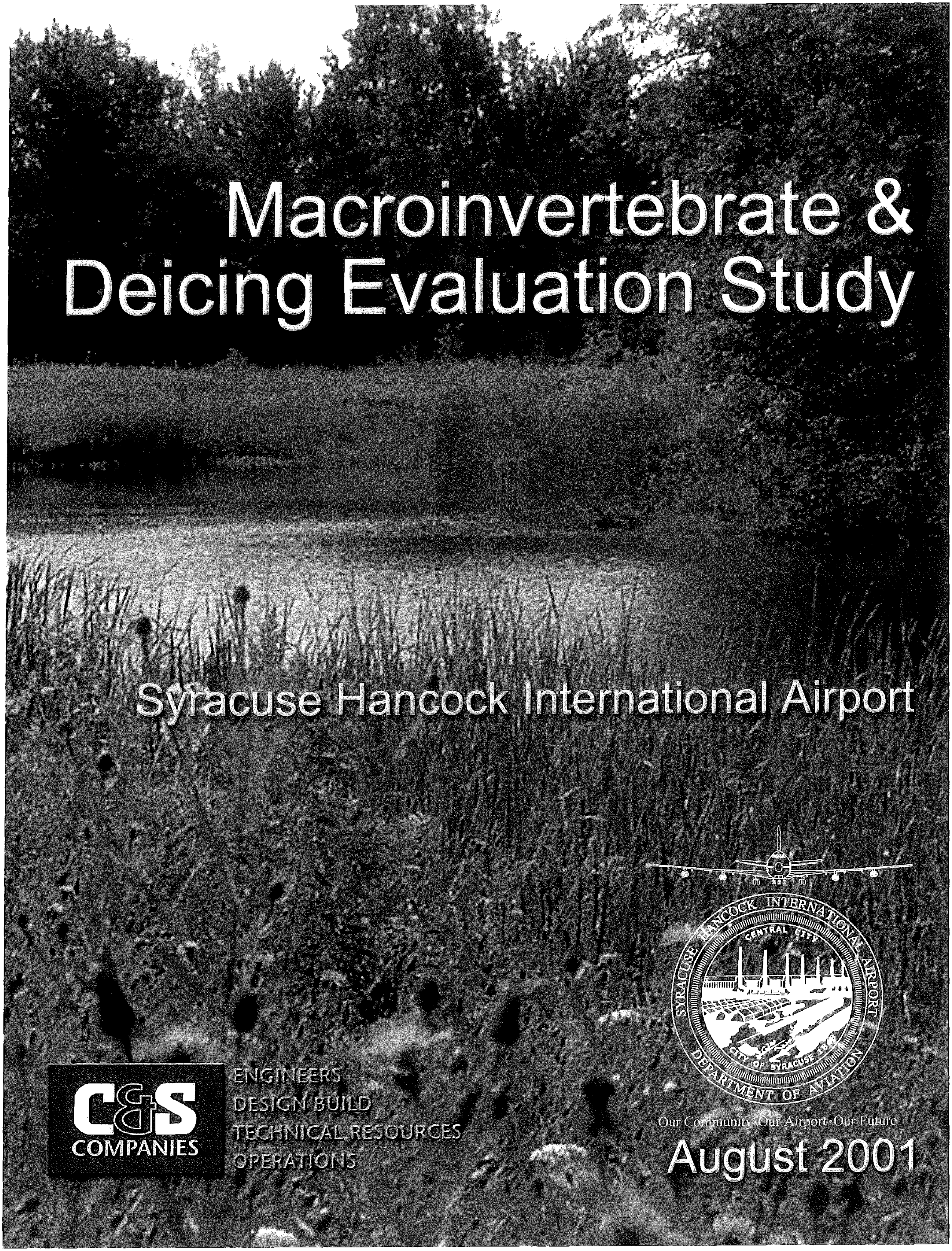

Macroinvertebrate & Deicing Evaluation Study

Syracuse Hancock International Airport

C&S COMPANIES

ENGINEERS
DESIGN BUILD
TECHNICAL RESOURCES
OPERATIONS

SYRACUSE HANCOCK INTERNATIONAL AIRPORT
CENTRAL CITY
CITY OF SYRACUSE 1848
DEPARTMENT OF AVIATION

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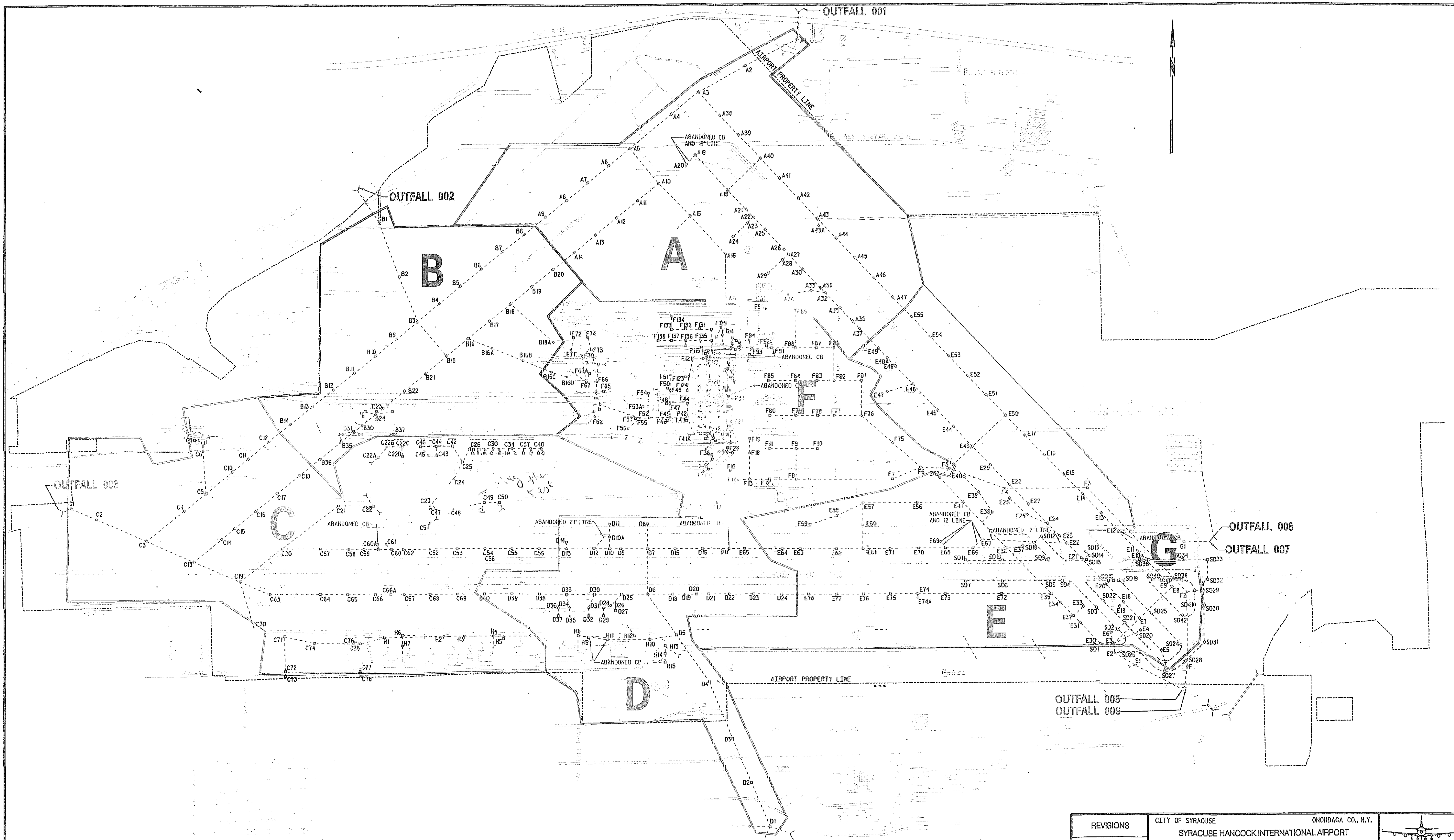
August 2001



GENERAL PLAN

SCALE: 1" = 500'

500 0 500 1000FT.

500'

NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK EDUCATION LAW

REVISIONS	CITY OF SYRACUSE ONONDAGA CO., N.Y.
	SYRACUSE HANCOCK INTERNATIONAL AIRPORT
	GENERAL PLAN
	OUTFALLS/TRIBUTARY AREAS
	ROY A. BERNARDI, MAYOR
	CHARLES R. EVERETT JR., COMMISSIONER OF AVIATION

C&S Engineers, Inc.
SYRACUSE, NY • BUFFALO, NY
BINGHAMTON, NY • MELVILLE, NJ

		FIGURE NO.
DATE:	NOVEMBER 1998	1
SCALE:	AS SHOWN	
FILE NO.	119.309.023	
CAD FILE NO.	ENV/SPDES/HANSAN.DGN	

SYRACUSE HANCOCK INTERNATIONAL AIRPORT
DEPARTMENT OF AVIATION

02/12/01

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1.0 INTRODUCTION

The Syracuse Hancock International Airport (SHIA) is located in North Syracuse, Onondaga County, New York. Figure 1 illustrates facilities at the SHIA and the stormwater drainage system. The City of Syracuse Department of Aviation (DOA) operates and maintains SHIA. The airport site is approximately 2000 acres.

The New York State Department of Environmental Conservation (NYSDEC) issued a State Pollutant Discharge Elimination System (SPDES) permit for the facility (NY-0244074) which includes effluent limitations with an effective date of October 1, 1997. Effluent limitations are numerical limits placed on the amount of a particular pollutant the permittee can discharge to the receiving waters. In addition, the SPDES permit required the construction of a collection and treatment system for the spent aircraft deicing fluid. A detailed description of the aircraft deicing collection and treatment system is provided in Section 1.1.

The SPDES permit monitoring which was conducted during the 1997-1998 indicated a number of exceedances of the effluent limitations. The apparent causes of these exceedances were a result of aircraft and/or airport deicing operations. As a result of these exceedances, the NYSDEC required the SHIA to enter into a Consent Order No. R7-1075-98-04 to address these exceedances. The City of Syracuse Common Council and the Mayor of Syracuse approved Ordinance Number 437 in October 1998 regarding the Consent Order between the City of Syracuse and the NYSDEC. The SHIA Consent Order required an evaluation of alternative methods of reducing contaminated runoff from SHIA including but not limited to implementation of the SHIA BMP Plan and collection and treatment of all contaminated runoff from all SHIA outfalls. Sections 2 through 4 of this report detailed the results of City's evaluation.

In addition, the Consent Order required SHIA to conduct a water quality study called a macroinvertebrate and tissue analysis study of the three creeks in which the airport discharges, to assist determining if airport operations having impacted the receiving streams. The results of this study are presented in Sections 5 and 6.

The Consent Order required the development of a workplan, which outlined the protocols for the macroinvertebrate study. The workplan was submitted by the DOA to the NYSDEC on October 2, 1998. The workplan was approved by the NYSDEC on October 5, 1998.

The SPDES permit also required the development and implementation of a Best Management Practices (BMP) Plan to prevent, or minimize the potential for, release of significant amounts of pollutants to the waters of the State through site runoff, spillage and leaks, sludge or waste disposal, or drainage from raw material storage. The BMP Plan dated August 1998 addresses the recommended controls and procedures, which were instituted at SHIA to minimize the potential for pollutants to enter the site runoff from the facility. The BMP Plan was approved by the NYSDEC.

1.1 DRAINAGE

Stormwater from the facility flows into various drainage structures located throughout the facility and eventually into one of the seven-permitted stormwater outfalls at the facility. These outfalls discharge into Beartrap, Mud, and Ley Creeks.

The estimated areas of impervious surfaces and total area tributary to each outfall are based on the Syracuse Hancock International Airport Drainage Plan developed by C&S Engineers, Inc. SHIA is serviced by seven outfall structures labeled 001-007, totaling over 1,400 acres of drainage area from on and off of the SHIA property. Outfall 008 receives the treated effluent from the SHIA aerated lagoons. Table 1 illustrates the estimated impervious area and total area tributary to each outfall.

Outfall 001 discharges to the north side of the SHIA property, crossing under Taft Road toward the Mud Creek system, eventually flowing into the Oneida River. Outfalls 002 and 003 discharge to the west into Bear Trap Creek, which subsequently flows into Ley Creek. Outfall 004 discharges to the south side of the SHIA property, Outfalls 005 and 006 to the southeast, and Outfalls 007 and 008 to the east, all discharging into the North Branch of Ley Creek.

2.0 AIRCRAFT DEICING

The FAA publishes Advisory Circular's (AC) to provide the regulated community with guidance procedures which are to be adhered to. The FAA has published an AC 120-58, dated 9/30/92, which is a Pilot Guide to Large Aircraft Ground Deicing. AC 120-58 states that Federal Aviation Regulations (FAR) prohibit takeoff when snow, ice or frost is adhering to wings, propellers, control surfaces, engine inlets, and other critical surfaces of the aircraft. This rule is the basis for the *clean aircraft concept*. The clean aircraft concept is essential to safe flight operations. The *Pilot-in-Charge (PIC)* has the ultimate responsibility to determine if the aircraft is in condition for safe flight.

Ground deicing and anti-icing procedures vary depending primarily on aircraft type, type of ice accumulations on the aircraft, and the aircraft deicing fluid type. The AC recommends that *All pilots should become familiar with the procedures recommended by the aircraft manufacturer* in the Aircraft Flight Manual (AFM) or the maintenance manual and, where appropriate, the aircraft service manual. The FAR Section 121.629 (c) require a certificate holder to have a ground deicing and anti-icing plan. These plans must incorporate any deicing procedures recommended by the aircraft manufacturers. Once this plan is approved, the FAR requires the airlines to follow the plan as written. Therefore, no actions could be taken which would deviate from the aircraft manufacturer's recommendations.

The aircraft deicing chemicals are applied to aircraft using mobile dispensing units. Concentrated aircraft deicing agent is mixed with water to produce a solution consisting of 30% to 60% deicing agent (presently propylene glycol). The percentage may vary among airlines and the fixed-base operators, especially during inclement weather conditions. Propylene glycol anti-icing agents are applied in concentrated form and are used to anti-ice aircraft.

2.1 Aircraft Deicing Collection/Treatment System

The City of Syracuse constructed an aircraft deicing fluid collection and treatment system. The system components include three remote aircraft deicing pads, one snow melt pad (for contaminated snow only), two pump stations, three 2.15 million gallon treatment lagoons and two 62,000 gallon steel storage tanks. The system became operational on November 29, 1996.

The snow melt pad is located northwest of the Terminal area. Snow, which accumulates on the aircraft deicing pads, is removed from the pads on a periodic basis. Snow which appears to be contaminated with aircraft deicing fluids will be removed from the deicing pads for storage on the snow melt pad. SHIA is one of few airports in the country, which uses a snow melt pad to collect runoff from visibly contaminated snow. As the snow on the pad melts, the resultant flow discharges to trench drains in the pad area. The flow from the trench drains discharges to a diversion structure. The flow in the diversion structure can be diverted either to the SHIA storm sewer system or to the North Equalization Tank. The flow entering the diversion structure during the deicing season is diverted to the North Equalization tank. The flow entering the diversion structure during the non-deicing season is diverted to the SHIA storm sewer system for ultimate discharge through Outfall 001.

A collection and conveyance system schematic of the SHIA is shown in Figure 2.

One of the deicing pads is located Northwest of the Terminal area and is referred to as the North Pad. The second pad is located to the Southwest of the Terminal area and is referred to as the South Pad. The third pad is located in the Air Cargo area and is referred to as the West Pad.

Fluids from the North Pad discharge to a trench drain. The flow from the trench drains discharges to a diversion structure. The flow in the diversion structure can be diverted either to the SHIA storm sewer system or to the North Equalization Tank. The flow entering the diversion structure during the deicing season is diverted to the North Equalization Tank. The flow entering the diversion structure during the non-deicing season is diverted to the SHIA storm sewer system for ultimate discharge through Outfall 001.

The North Equalization Tank is connected to the North Pump Station. The North Equalization Tank is also equipped with overflow piping. If the flow entering the North Equalization Tank exceeds the pump capacity of the North Pump Station and storage capacity of the North Equalization Tank the excess flow is discharged through the overflow piping. The overflow volume is discharged to the SHIA storm sewer system for eventual discharge though Outfall 001. The North Pump Station conveys the flow to the treatment system through a force main.

The West Pad is equipped with trench drains with the resultant flow discharging to a diversion structure. The flow in the diversion structure can be diverted to either the SHIA storm sewer system or to Diversion Structure S-1. The flow entering the diversion structure during the deicing season is diverted to Diversion Structure S-1. The flow entering the diversion structure during the non-deicing season is diverted to the SHIA storm sewer system for ultimate discharge through Outfall 003.

The South Pad is equipped with catchbasins with two diversion structures. The flow in the Diversion Structure S-2 can be diverted to either the SHIA storm sewer system or to Diversion Structure S-1. The flow entering the diversion structure during the deicing season is diverted to Diversion Structure S-1. The flow entering the diversion structure during the non-deicing season is diverted to the SHIA storm sewer system for ultimate discharge through Outfall 004. The flow in the Diversion Structure S-1 can be diverted to either the SHIA storm sewer system or to the South Pump Station. The flow entering the diversion structure during the deicing season is diverted to South Pump Station. If the flow entering the Diversion Structure S-1 exceeds the pump capacity of the South Pump Station and storage capacity of the Diversion Structure S-1, the excess flow is discharged through the overflow piping. The overflow volume is discharged to the SHIA storm sewer system for eventual discharge though Outfall 004. The flow entering the diversion structure during the non-deicing season is diverted to the SHIA storm sewer system for ultimate discharge through Outfall 004. The South Pump Station conveys the flow to the treatment system through a force main.

Flow measurements and sampling of the influent to the lagoon system is performed. An automatic sampling device collects an influent sample. The sample is analyzed for total carbon using a total carbon analyzer, which is housed in the control building. According to published literature, propylene glycol is 47.35% carbon. The results of the total carbon analysis are transmitted to a programmable logic controller (PLC). The PLC determines whether the influent is diverted to the one of two steel storage tanks or the lagoon system.

The influent to the tank storage system will be diverted to one of the two 62,000 gallon storage tanks. The storage tanks are used to store wastewater with higher glycol concentrations greater than 15%. Typically, the storage tanks contents will be trucked off-site for treatment or recycling. The fluid will be pumped into tanker trucks using the truck loading pump station. The tanker trucks are parked on a truck-loading pad.

The storage tanks are also equipped with overflow piping. Any flow, which enters the overflow piping, will be discharged to the lagoon system.

The influent flow, which is not diverted to the storage tanks, is discharged to the lagoon system. The lagoon system is comprised of three 2.15 million gallon lagoons and a lagoon drain pump station.

The contents of the lagoon are treated using an aerobic treatment system comprised of floating mechanical aerators to effect biodegradation of the captured runoff. The lagoon drain pump station (ldps) is used to drain the contents of any or all of the three lagoons. The ldps can direct flow through Outfall 008 following treatment. The ldps also can discharge to tanker trucks positioned on the truck-loading pad. The ldps can direct flow into any of the three lagoons.

Lagoon 1 is equipped with an overflow pipe with the resultant flow being discharged through Outfall 008.

The drainage from the truck-loading pad is discharged to a truck loading sump pump station with the resulting flow being discharged to the lagoon drain pump station. The floor drains in the control building discharge to the truck loading sump pump station.

2.2 Aircraft Deicing/Anti-icing Minimization Practices

SHIA implemented the procedures outlined in the BMP Plan. In addition, SHIA has implemented a number of structural and non-structural best management practices to enhance the effectiveness of the existing collection system. The following is an outline of the additional practices which have been implemented following the development of the BMP Plan:

Restrictive Tenant Directives

In September 1998, the City revised the tenant directive for aircraft deicing/anti-icing. This revision set forth much more restrictive practices in regards to aircraft deicing/anti-icing.

Prior to the revised directive the tenants determined if it was appropriate to deice/anti-ice aircraft outside of the dedicated deicing pads. The following is a portion of the revised tenant directive:

Each company conducting aircraft deicing, anti-icing and/or defrosting operations at SHIA **must** have a tow bar and readily available access to equipment capable of moving each aircraft type that they deice.

No deicing, anti-icing, and/or defrosting activities are permitted anywhere on the SHIA except on the three deicing pads or except as specifically approved pursuant to the protocol established in this document. Off-pad aircraft deicing, anti-icing, and/or defrosting activities are **only** permitted in the event one of the following three conditions are met:

(1) Defrosting. If the aircraft cannot be moved (i.e., taxied, tugged, or towed) then, the City **must** be notified **prior** to any off-pad aircraft deicing activities being conducted to receive possible authorization from the City for the off-pad deicing. A typical defrosting scenario follows: when pre-taxi inspection of an airplane during above-freezing ambient temperatures reveals the build-up of clear ice on critical components of the airplane, including, but not limited to, the windshield and inlet ducts, such that FAA regulations require the defrosting, or deicing of those components before the airplane may be moved (i.e., taxied, tugged, or towed) to the deicing pad for complete defrosting or deicing (if complete deicing or defrosting is necessary), and if the City grants authorization, then the minimum amount of deicing fluid required to comply with FAA regulations may be applied to the aircraft before moving to a deicing pad for complete deicing.

(2) Deicing. If the aircraft cannot be moved (i.e., taxied, tugged, or towed) then, the City **must** be notified **prior** to any off-pad aircraft deicing activities being conducted to receive possible authorization from the City for the off-pad deicing. A typical deicing scenario follows: when pre-taxi inspection of an airplane reveals the presence of ice, snow or frost on critical components of the airplane, including, but not limited to, the windshield and engine inlet ducts, such that FAA regulations require deicing of those components before the airplane may be moved (i.e., taxied, tugged, or towed) to the deicing pad for complete deicing, and if the City grants authorization, then the minimum amount of deicing fluid required to comply with FAA regulations may be applied to the aircraft before moving to a deicing pad for complete deicing.

If the aircraft cannot be moved (i.e., taxied, tugged, or towed) then, the City **must** be notified **prior** to any off-pad aircraft deicing activities being conducted to receive possible authorization from the City for the off-pad deicing. When pre-taxi inspection reveals heavy snow and ice on the airplane such that the airplane exceeds the maximum structural taxi weight permitted by FAA regulations, and no other method of heavy snow removal is available, and if the City grants authorization, then the minimum amount of deicing fluid required to comply with FAA regulations may be applied to the aircraft before moving to a deicing pad for complete deicing.

(3) Anti-Icing. If the aircraft cannot be moved (i.e., taxied, tugged, or towed) then, the City **must** be notified **prior** to any off-pad aircraft deicing activities being conducted to receive possible authorization from the City for the off-pad deicing. If the City grants authorization, the quantity of glycol applied to the aircraft outside of the deicing pads **must** be **limited** to the amount necessary to allow the aircraft to travel to the deicing pads for full deicing. For airplanes remaining at the gate or ramp overnight, or for cargo airplanes remaining at the ramp for an extended period during the day, an Operator may apply anti-icing fluid rather than deicing fluid at the gate **if all of the following conditions are met:**

a) Anti-icing cannot be applied at a deicing pad because no pilot is available to take the airplane to the deicing pad; and

b) The Operator anticipates the overnight accumulation of ice, snow or frost on critical components of the airplane including, but not limited to the windshield and engine inlet ducts or anticipates the same type of accumulation during the day on a cargo airplane; and

c) FAA regulations require the deicing of those critical components before the airplane is permitted to move to the deicing pad for complete deicing; and

d) The application of ant-icing fluid at the gate or ramp will reduce the necessity for later application of deicing fluid at the gate or ramp in order to comply with FAA requirements before moving to the deicing pad for complete deicing.

The following is the City's aircraft deicing, defrosting, and/or anti-icing procedures:

(1) Aircraft must be moved (i.e., taxied, tugged, or towed) to the deicing pad;

(2) If aircraft cannot be moved (i.e., taxied, tugged, or towed) to deicing pad, the City **must** be notified **prior** to any off-pad aircraft deicing, anti-icing and /or defrosting activities being conducted to receive possible authorization from the City;

(3) If the City grants permission for off-pad deicing, anti-icing and/or defrosting activities to be conducted the following procedures must be followed in the order in which they appear:

a) It is the responsibility of the deicing company to position a rubber mat and weight it down over the storm drainage structure which would receive the glycol runoff resulting from the off-pad deicing, anti-icing, and/or defrosting activities;

b) Then the minimum amount of deicing fluid required to comply with FAA regulations may be applied to the aircraft before moving to a deicing pad for complete deicing;

c) It is the responsibility of the deicing company to apply absorbent material to tributary area in which the glycol has spread. In addition, it is the responsibility of the deicing company to cleanup and properly disposes of the spent absorbent material once the material has absorbed the spent glycol. The City on occasion **may** assist in the cleanup of the absorbent material if sufficient equipment and manpower are available.

d) No aircraft will be permitted in this area until **all** the absorbent material has been removed.

(4) The City's sampling contractor must be notified of any off-pad deicing and/or anti-icing activities within 30 minutes of the glycol application.

Each company conducting aircraft deicing, anti-icing, and/or defrosting activities at SHIA must provide the City with written certification prior to the start of each deicing season that each of its employees who are conducting aircraft deicing, anti-icing, and/or defrosting activities have been trained and understand the City's procedures.

The SHIA SPDES permit requires the City to collect water quality samples from the SHIA stormwater outfalls if deicing, anti-icing and/or defrosting activities are conducted outside the dedicated deicing areas. Aircraft that are de-iced outside one of the dedicated pads must notify the City's sampling contractor. The company conducting the deicing activities is responsible for the notification procedure.

The following information must be included in the notification process:

- Name of firm conducting deicing operations;
- Name of aircraft operator (i.e., airline or air freight company);
- Area in which deicing/defrosting activities occurred;
- Time the deicing, defrosting and/or anti-icing activities were conducted; and
- Amount, concentration and type of aircraft deicing fluids used.

In February 2001, the City enacted a new policy requesting a reduction in the number of aircraft being deiced with their engine running. A total prohibition of deicing with engine running could not be enacted because a number of the aircraft serving SHIA could not restart the engines with aid of auxiliary power units.

The City discussed more efficient uses of the deicing pads including taking into account wind direction, and positioning of aircraft in the center of deicing pads when space is available.

Deicing with engines running is a common practice. The airlines like to deice aircraft with the running because it requires additional time to restart engines after deicing activities. The airlines indicate that it is more difficult to restart "hot start" engines. In addition, the number of engine starts plays a factor in the frequency of aircraft engine maintenance.

Glycol Proportioning

Type I Aircraft Deicing Fluid is used to deice aircraft. Most of the airlines at SHIA purchase prediluted fluid in a 50/50-glycol and water mixture. The Fixed Based Operators (FBO) and the 174th Air National Guard (ANG) purchase concentrated Type I fluid and on occasion adjust the glycol concentration to the level which is appropriate for the weather conditions. This practice allows for lower glycol concentration to be applied to the aircraft during milder weather conditions.

New York Air National Guard Procedures

On previous occasions, the ANG conducted aircraft deicing, anti-icing, and/or defrosting activities on their ramp area. The drainage from the ramp discharges to a drainage swale, which ultimately discharges to the SHIA storm sewer system through Outfall 005. The SHIA SPDES permit requires that the tributary outfalls be sampled following the application of aircraft or airport deicing chemicals outside of the dedicated deicing areas. The ANG is responsible for notification for all aircraft deicing anti-icing, and/or defrosting by their personnel to the City.

Currently, the ANG utilizes the City's dedicated deicing pads for the deicing of their aircraft. In the fall of 2000, the ANG completed the construction of hangars for their F-16s thus reducing the frequency and amount of deicing chemical application. In addition, the ANG has constructed an aircraft deicing pad constructed within their apron area.

Mechanical Removal Methods

Some of the deicing companies use on occasion mechanical methods to remove ice and snow from aircraft. Dry, powdery snow can be swept from the aircraft using brooms, brushes and/or leaf blowers. In addition, some smaller aircraft are equipped with inflatable pneumatic or hydraulic boots that expand to break ice off the leading edges of wings and elevators.

Mechanical snow removal methods are typically only used alone in the early morning because they are time and labor-intensive and could be disruptive to airline schedules. Mechanical methods are normally used along with glycol application.

Oversight

The City has developed an Operation Division within the Department of Aviation. One of the functions of this group is to monitor the use of the dedicated aircraft deicing pads by the tenants to determine if the tenants are following the City procedures. If City personnel observe a tenant not following the procedures; the person will provide the tenant with the necessary guidance as to the City's procedures. With the addition of these personnel, the City is better suited to comply with their SPDES permit.

Ordinance Revision

In October 1998, the City of Syracuse Common Council revised the City General Municipal Ordinance to provide the Commissioner of Aviation with the ability to levy fines on airport tenants that do not follow the airport's established deicing procedures.

Signage and Lighting

Since the deicing pads have become operational certain features were added. Additional signage and lighting equipment were installed to assist pilots in positioning their aircraft in the proper location on the deicing pad to help prevent deicing fluid from being applied outside the deicing pad.

Deicing Pad Expansion

The North and South Deicing Pad was repaved and expanded in the summer of 2000 in an effort to continue to improve the effectiveness of the collection system. This project provided a larger collection area and smoother surface for faster, more complete drainage of glycol. The costs for this project were approximately $300,000.

Educational Benefits

Members of the DOA attend annual airport deicing conferences to learn about new deicing products and procedures. In addition, it provides an opportunity for DOA personnel to learn and share experiences with other airport operators to gain additional knowledge.

3.0 AIRPORT DEICING/ANTI-ICING

Airport deicing/anti-icing removes or prevents the accumulation of frost, snow, or ice on runways, taxiways, aprons, and ramps. Combinations of mechanical methods and/or chemical deicing/anti-icing are used. Unlike aircraft deicing/anti-icing, which is conducted by various tenants, airport deicing/anti-icing is conducted by City personnel with assistance from an outside contractor. The Fixed Based Operators (FBOs) uses mechanical methods to maintain their leased ramp areas. SHIA is reportedly the snowiest airport hub in the continental United States.

The City has extensive collection of snow removal equipment including plows, brushes, and blowers. In addition, the City has retained a private contractor with their fleet of equipment to assist the City in snow removal. Mechanical means are the most common and preferred method of airport deicing/anti-icing at SHIA.

Under certain conditions, mechanical methods alone will not adequately provide safe operating conditions. In these cases, the City will utilizes chemical deicing/anti-icing in conjunction with mechanical methods to provide safe operating conditions. There are a number of FAA approved airport deicers/anti-icers including urea, ethylene and propylene glycol, potassium acetate, sodium formate, sodium acetate, etc.

3.1 Selection of Airport Deicer/Anti-icer

Prior to 1998, the airport used urea to deice/anti-ice runways, taxiways, and ramp areas to reduce ice build-up in the winter months. The urea is applied using truck-mounted spreaders. The application of urea as a runway-deicing chemical was greatly reduced during the 1997-1998 deicing season. In the future, urea will be utilized only in an emergency situation.

The City became aware of the environmental impact of using urea. The City conducted a review of applicable airport deicers/anti-icers and chose to switch to potassium acetate because it was the most environmental friendly FAA approved deicing/anti-icing agent. In March of 1998, the City discontinued the use of urea and began using potassium acetate to reduce the potential environmental impact from airport deicing/anti-icing operations.

The urea is a solid material and potassium acetate is a liquid, which resulted in the City having to acquire a new de-icing/anti-icing vehicle. This vehicle is equipped with computer controlled dispensers which provides a more uniform distribution of chemicals than the former system. The cost of this truck was approximately $150,000.

Potassium acetate is applied to airport pavement surfaces to assist in the prevention of bonding of freezing precipitation to the pavement or, under usual circumstances, to help the melting of frozen precipitation. The rate of application is controlled by a Dickey-john DjCCS100 control system. The use of this device allows the uniform rate of application. The City used an application rate of 1/2 gallon per 1,000 square feet during the 1998-deicing season.

The 1/2 gallon per 1,000 square feet application rate is lowest application rate for which the manufacturer provides equipment calibration curves. The rate of application must take into account the operating ground speed of the application vehicle. For example, the 1/2 gallon/1,000 square feet application rate is determined by a ground speed of 17 to 31 m.p.h.

The ANG deices its aircraft-parking ramp using potassium acetate on an as needed basis. The resultant flow is discharged to a drainage swale, which enters into the SHIA storm sewer system for ultimate discharge through Outfall 005. The SHIA SPDES permit requires that the tributary outfalls be sampled following the application of airport deicing chemicals including urea or potassium acetate. The ANG must notify the City's sampling contractor whenever the Air Guard uses potassium acetate.

3.2 Re-Evaluation of Airport Deicer/Anti-icer

In an effort to be environmentally diligent, the City during the winter of 2000 conducted a re-evaluation of current FAA approved airport deicers/anti-icers to determine if the use of potassium acetate was still appropriate. Many new products have been commercialized since SHIA starting using potassium acetate, so a re-evaluation was warranted. The following is a brief description of each evaluated product from an environmental and operational standpoint.

Urea

Urea has been, by far, the most widely used runway deicer. However, ammonia, as a byproduct of urea, is toxic to aquatic life. In fact, a study, conducted by Transport Canada, concluded that while urea is effective as a runway deicer, the environmental impacts associated with the use of the product are impractical to mitigate and alternative runway deicing agents should be sought to replace urea.

Urea-Ethylene Glycol Mixture

Union Carbide manufactures a liquid runway deicer that is mixture of ethylene glycol and urea. This product has one of highest BOD_5 values of the runway deicers evaluated and has the potential production of ammonia that is toxic to aquatic life.

The remainders of the products to be evaluated do not contain urea and will not produce ammonia as a degradation by-product

Sodium Acetate

Performance tests have shown that sodium acetate requires approximately 1/3 less product than urea to achieve similar results over a range of temperatures. In addition, sodium acetate reacts faster with ice than urea. Sodium acetate is available in a solid form and can be used in conjunction with liquid runway deicer as a wetting agent. A disadvantage is the cost of the product, which is approximately four times the cost of urea. Considering the smaller amount used, the cost per unit area treated is approximately three times that of urea.

Sodium Formate

Sodium formate requires substantially less product (40% to 60%) compared to urea to produce similar results. It is manufactured in an irregular shape, which makes is less likely to being wind blown than pelletized products. In addition, it is more effective at lower temperatures than urea but not to the extent of the acetate based products. A disadvantage is the cost, approximately 3 times that of urea, but 50% less product is required for similar treatment. Considering the smaller amount used the cost per unit area treated is approximately one and half times that of urea.

Calcium Magnesium Acetate

Calcium magnesium acetate is a solid material and because of its shape is prone to being wind blown. It has a slower response time in comparison to the other FAA approved runway deicers. Its associated BOD_5 is one of the highest of the deicers evaluated and cost three times as much as urea with similar application rates.

Potassium Acetate

Potassium acetate has numerous operational advantages over glycol and urea based deicers including melting snow and ice faster and at lower temperatures, providing a longer residual effect and being less slippery. Potassium acetate has the lowest BOD_5 of any of the FAA approved runway deicers. It is most effective when used as an anti-icier. Considering the smaller amount used, the cost per unit area treated is approximately 2 times that of urea. Currently, SHIA uses potassium acetate as a runway deicer.

Propylene and Ethylene Glycol

Both products are effective in low temperatures and are one of most effective runway deicers other FAA approved products. The BOD_5 of these products are on the high end of the range. Considering the smaller amount used, the cost per unit area treated is approximately 2 times that of urea.

Summary

Based on the results of the evaluation, SHIA continues to use potassium acetate as its runway deicer/anti-icer because it is the most environmental friendly of the approved FAA airport deicing/anti-icing agents, and meets SHIA operational requirements.

3.3 Airport Deicing/Anti-icing Minimization Practices

The City has established various minimization practices to reduce the frequency and amount of chemical applied during airport deicing/anti-icing operations. This section outlines the City efforts to meet that goal:

Good Winter Maintenance Practices

SHIA personnel utilizes the following winter maintenance practices to prevent unnecessary or over-application of pavement deicing/anti-icing chemicals:

- Prompt treating of airfield pavements using mechanical methods or anti-icing chemicals to prevent strong bonds from forming between the frozen precipitation and the pavement surface;
- Using mechanical methods to remove dry snow from airfield pavements, rather than applying deicing/anti-icing chemicals;
- Applying pavement anti-icing chemicals prior to a storm event or icing conditions, when weather forecasts indicate that ice or snow will bond to pavement surfaces;

Pavement Anti-icing

Pavement anti-icing is the preferred method by airport personnel for maintaining safe operation conditions at the airport. Anti-icing can prevent the development of strong bonds from forming between the pavement and ice which enables snow and ice to be more easily removed by mechanical means. The proper application of anti-icing chemicals can dramatically reduce the amount of pavement deicing and/or anti-icing chemicals used by the airport. According to some reports, airport deicing can take up to five times the quantity of chemical as anti-icing. The timing of the application of pavement anti-icing chemicals is critical. In order for anti-icing agents to be most effective they should be applied to a clean pavement and while the surface temperature is above freezing. The airport utilizes weather forecasts and a runway surface condition monitoring system in effort to accurately predict runway surface conditions in order to determine the appropriate timing of anti-icing chemical application.

Runway Surface Condition Monitoring System

The SHIA Runway Surface Condition Monitoring System (RSCMS) consists of surface condition sensors, atmospheric sensors, subsurface temperature probes, computer hardware and software, and video displays. The surface conditions sensors which are embedded in the pavement measures the pavement temperature and detect surface contamination, such as water, ice, snow, and residual deicing/anti-icing chemicals. Surface conditions sensors are used to collect and transmit data to the central computer server. Both of SHIA's two runways are equipped with surface conditions sensors.

The atmospheric sensors measure air temperature, relative humidity, wind velocity and direction, and the type and rate of precipitation. The subsurface probes are used to measure the ground temperature, which can be used to determine future pavement surface temperatures. The system integrates weather information from the National Weather Service along with the data collected from the remote sensors to predict pavement conditions up to 24 hours in advance.

In the summer of 2000, the airport conducted a major upgrade of their RSCMS, which included replacement of malfunctioning remote sensors; new windows based software, and computer processing equipment. Following the upgrade, the airport is better suited to more accurately predict pavement conditions which will in turn assist the DOA in preventing unnecessary and/or minimizing the application of pavement deicing/anti-icing chemicals.

4.0 ALTERNATIVE METHODS OF REDUCING CONTAMINATED RUNOFF

The SHIA Consent Order required an evaluation of alternative methods of reducing contaminated runoff from SHIA including but not limited to implementation of the SHIA BMP Plan and collection and treatment of all contaminated runoff from all SHIA outfalls. As stated in the previous sections SHIA has implemented the procedures contained in the SHIA approved BMP Plan.

4.1 Collection/Treatment of All SHIA Runoff

The following is an analysis of collecting and treating all contaminated runoff from the SHIA outfalls. Based on engineering experience and technical literature, glycol recycling, physical-chemical treatment systems and biological treatment systems were identified for preliminary consideration.

4.1.a Treatment Alternatives

Since different treatment technologies have different spatial requirements and different storage requirements, determination of appropriate treatment technologies was conducted separately.

The following discussion presents the general characteristics of several treatment options for each of the categories listed, and identifies and screens specific treatment objectives.

4.1.a.1 Glycol Reclamation

The glycol recovery system could make use of three processes to recover glycol. The processes are as follows:

(A) Filtration

The first system that the collected glycol runoff would pass through would be a filtration process. Filtration is a method used to separate particles from fluids by retaining them on filter material. The primary pollutants expected at SHIA would be dirt, grit and water. On its own, filtration would not be a viable process for treating runoff because the resulting filtered material would be a dilute glycol.

With the use of the glycol recovery system, it will be necessary for SHIA to continue to use only one type of aircraft de-icing fluid; it would be very difficult to control the quality of a recovered glycol containing more than one fluid type.

(B) Ion Exchange

After filtration, the second process that the runoff passes would pass through would be an ion exchange unit. The ion exchange process consists of a chemical reaction between ions in a liquid phase and ions in a solid phase to remove undesirable ions from the water. The ion exchange unit in the recovery system would be used to remove materials such as chlorides and sulphates from the fluid.

(C) Distillation

Since the recovered glycol usually contains excess water, a distillation system would be utilized to remove a desired amount of water to produce the final glycol solution. The main purpose of distillation is to separate a mixture having several components by taking advantage of the different volatilities of the components.

In the distillation process, steam is fed to a heat exchanger where the collected runoff fluid is heated up. Excess water in the recovered fluid is evaporated from the top of the distillation tower. The steam emitted from the distillation tower is fed to a preheater where fluid is heated up prior to spraying it into the distillation tower. The excess heat from the distillation process can be used for other purposes, or it may be required to be cooled with air or water prior to discharge to the atmosphere.

The economics of on-site glycol reclamation are heavily dependent on the glycol concentrations of the run-off. Concentrations of less than about 10 to 15% are currently considered uneconomical for such reclamation. Therefore, considering the extremely low glycol concentration at SHIA, this system was not retained for further consideration.

4.1.a.2 Physical/Chemical Treatment Systems

The physical-chemical processes were selected due to the following characteristics:

- The ability to treat a wide range of organic concentrations
- Insensitivity to stormwater temperature
- Capability of start-stop operation without requiring acclimation.

(A) Supercritical Water Oxidation:

Supercritical Water Oxidation (SCWO), commercialized by EcoWaste Technology (Austin, Texas) is a treatment system that destroys organic contaminants and produces carbon dioxide. Known also as hydrothermal processing, SCWO uses high temperature supercritical water to accelerate the oxidation of organic wastes. The SWO process produces no pollutants. The first commercial application was installed in 1994 in Austin, Texas.

Based on manufacturer's information, SCWO has not been retained for further consideration due to its unsuitability for treatment of stormwater. The technology is cost- effective for concentrated mixtures with organic concentrations in the order of 50,000 mg/L. Therefore; this process is not economical for treating BOD concentrations as low as those present in the stormwater at SHIA.

(B) Storm Filter System:

The Storm Filter System manufactured by Stormwater Management (Portland, Oregon) uses a pelletized compost medium to filter solids, and remove soluble heavy metals through cation exchange. The system is used to treat stormwater runoff at more than 230 sites in the U.S. The technology uses less than 10% of the land required by conventional stormwater treatment methods.

Based on manufacturer's recommendations, the Storm Filter System has not been retained for further consideration for treatment of the airport stormwater. It is well suited for filtration of solids and grit, but does not remove soluble organics. Therefore, this process was not retained for further consideration.

4.1.a.3 Biological Treatment Systems

The biological processes are well proven and well suited to treat stormwater containing biologically degradable constituents such as glycol. However, concerns associated with biological processes in this application include:

- Slow rates of reaction under cold temperature conditions
- Sensitivity to the varying flows and organic loadings associated with the periodic nature of stormwater discharges.

Biological treatment is a process in which microorganisms convert organic matter in the waste stream to gases and cell tissue. The major biological processes are either aerobic (occur in the presence of oxygen) or anaerobic (occur in the absence of oxygen). Both aerobic and anaerobic systems are available that maintain microorganisms either suspended in activated sludge or attached to a fixed, inert media.

(A) Aerated Lagoon

The aerated-lagoon process uses a constructed reactor or lined earthen basin with suspended active biomass for aerobic degradation of BOD. The aerobic, mixed environment in the reactor is achieved by the use of diffused or mechanical aeration. Some aerated lagoons are used in conjunction with settling facilities and employ recycle of biological solids. The majority use operation without external recycle.

At the beginning of the treatment season, the lagoons would require seeding with activated sludge from a local sewage treatment plant or from a commercial supplier.

Advantages

- Widespread usage and acceptability for treating wastewater
- Operation and maintenance procedures are well documented and qualified operators are available.

Disadvantages

Disadvantages of the aerated lagoon process for seasonal and variable flows include:

- During the beginning and end of the deicing season BOD loadings to the systems would likely be infrequent and low, resulting in low food availability to the microorganisms;

- The lagoons require a large amount of space relative to other systems and the energy costs associated with aerating treatment lagoons are high;
- Installation would create open water areas that may be unacceptable in proximity to the airport;
- Treatment efficiency would be compromised during periods of low ambient temperatures.

Because of the proven technology, the aerated lagoon system was retained for further consideration for this application.

(B) Activated Sludge

Activated sludge is a common suspended growth, aerobic system for BOD removal. As in aerated lagoons, the aerobic, mixed environment in the reactor is achieved by the use of diffused or mechanical aeration. Microorganisms are separated from the treated wastewater through settling in a separate tank. A portion of the biological solids is recycled back to the reactor. Waste products include settled solids (sludge) which require on-site or off-site treatment prior to disposal. Large fluctuations in wastewater flow or organic loadings require equalization prior to treatment with an activated sludge system.

Advantages

- Activated sludge treatment is a proven technology for treatment of domestic and industrial wastewater
- Operation and maintenance procedures are well documented and qualified operators are available.

Disadvantages

- This process requires experienced personnel to operate and fine-tune biomass recirculation and wasting to achieve satisfactory effluent.
- During the beginning and end of the deicing season BOD loadings to the systems would likely be infrequent and low, resulting in low food availability to the microorganisms;
- Installation would create open water areas that may be unacceptable in proximity to the airport; and
- Treatment efficiency would be compromised during periods of low ambient temperatures.

Therefore, this process is retained for further consideration for application at SHIA.

(C) Sequencing Batch Reactor:

A sequencing batch reactor (SBR) is a fill-and-draw activated sludge treatment system. Aeration and settling are carried out sequentially in the same tank. There is no need for recycling of biological solids into the reactor. Waste products include settled solids (sludge) which require on-site or off-site treatment prior to disposal. Large fluctuations in organic loadings require either equalization prior to treatment or the ability to vary the operating capacity of the treatment units.

The SBR system is comparable to an activated sludge system and may be smaller and less costly. It is also simpler to operate due to the lack of sludge recycle and better suited to handle variable flows and loads.

Advantages

- Simultaneous biological treatment and solids separation in the same reactor eliminating the need for separate solids settling
- Reduced space requirements for treatment relative to lagoon treatment
- Relatively simple treatment process with no recycle streams
- Due to relatively long retention times, the system is less vulnerable to fluctuations in organic loads

Disadvantages

- Require more operational control to monitor consistent process efficiency relative to continuous treatment processes.

Therefore, this alternative will be retained for further consideration.

(D) Biological Aerated Filter:

The Biological Aerated Filter (BAF) is a fixed-film treatment system used to produce high levels of treatment. The filter unit consists of a submerged, aerated bed of highly permeable, inert media. Excess biomass is separated from the media by backwashing. An advantage of the BAF over an activated sludge treatment system is that a higher density of biological biomass can be maintained, thereby allowing treatment of higher flows within a given volume. Therefore, the system requires less land and less operational control than a suspended growth biological system. The BAF system can also handle high fluctuations in wastewater flow. Large fluctuations in organic loadings require either equalization prior to treatment or the ability to vary the number of operating treatment units.

BAF units are typically operated automatically, by Programmable Logic Control (PLC). Frequency of backwashing is dependent on solids and organic loading to the units and is estimated to be required at 36-hour to 48-hour intervals for this application. Backwash can be conducted on a preset schedule or when the pressure drop across the filter reaches a defined magnitude.

Since the BAF system can operate with large variations in flow, this technology was retained for further consideration for this application.

Advantages

- Smaller space requirements for the treatment component of the system
- Process performs well under a wide range of influent flows
- Process performs relatively well under decreased temperature conditions
- Solids from BAFs have good settling characteristics
- Modular construction is adaptable to changing influent conditions.

Disadvantages

- BAF systems employ proprietary design and manufacture components, which tends to increase equipment and installation costs
- Operation of the system is more complex than the other systems
- Special training of operating personnel is usually required due to the advanced process instrumentation and control used
- Higher head losses through the system require additional pumping
- Process may be vulnerable to sudden undetected fluctuations in organic or suspended solids loads.

Therefore, this alternative has been retained for further consideration.

(E) <u>Anaerobic Biological Treatment</u>

Anaerobic treatment processes include suspended and attached growth processes. Suspended growth anaerobic systems include sludge stabilization digesters, anaerobic contact processors, and upflow anaerobic sludge-blanket systems. Attached growth anaerobic treatment systems include fixed bed and expanded bed systems. Anaerobic systems are usually selected for application to high strength (COD concentrations ranging from 1,500 to 20,000 mg/L) industrial or mixed waste streams and sludges. Although anaerobic attached growth systems have the potential to treat lower strength wastes, these applications have not been widely implemented.

Disadvantages

- High sensitivity to low influent temperature
- Long retention times and large reactor volumes;
- Production of methane and or hydrogen sulfide waste products, which must be removed to avoid explosion hazards or objectionable odors, respectively; and

- Inability to treat variable flows and loads.

Based on the above disadvantages, no anaerobic biological treatment technologies have been retained for further consideration for this application.

4.1.b Storage Requirements

Installation of an open water storage tank at the airport would be contingent upon FAA approval. Due to the general concerns related to large open-water areas near airports, the issue of stormwater storage should be considered for each treatment alternative.

Stormwater storage for flow and concentration equalization was evaluated. The stormwater volumes were calculated using the 95% of the precipitation would be collected over the impervious surfaces and 5% of precipitation would be collected from the pervious surfaces. An average annual precipitation rate of 37 inches was used in this analysis. Since the majority of deicing activities occurs from October 1 to May 1, the precipitation for those months was included in the quantity to be collected and treated. A 1.5 safety factor was added to the average condition in order to account for precipitation from an unusually heavy year. Table 2 summarizes the results of stormwater storage modeling for the all of the outfalls.

The majority of the precipitation during this deicing season is in the form of snow. The snow falls on the paved surfaces and is plowed onto frozen pervious surfaces. The precipitation contained within the snow pack is stored there until such time as weather conditions cause the snow pack to melt. The duration and frequency of these thaw cycles is highly variable from year to year and as such makes the prediction of stormwater runoff volumes highly unpredictable. For this analysis, it is assumed that storage facilities would have to be sized to collect all of the precipitation from October 1 to May 1 and that the treatment process would not be started until May 1.

This would allow for the efficient operation of the treatment systems without having to conduct multiple starts and stops of the treatment system. In addition, the treatment efficiency would be impacted during the each startup of the treatment system and the impact of winter temperatures.

If one storage/treatment facility were to be utilized to collect and treat all contaminated runoff, this facility would be required to store 440,573,000 gallons of collected stormwater plus any precipitation which falls within the open storage area. This analysis is assuming that the stormwater generated during the remainder of the year would not be required to be collected and treated.

The SHIA storm sewer outfalls are located between 8 and 20 feet under the ground surface. As can be seen in Figure 1, the distance between the all of the outfalls precludes the practicality of installing one system to treat the combined stormwater flows. Pump stations would need to be installed at each outfall to convey the stormwater to one location. Based on the sizing requirements the storage facility would be 175 acres. There is not sufficient room to locate facility of this size at SHIA.

In addition, it was impractical to construct storage/treatment facilities at each of the outfall locations due to lack of available land in close proximity of each of the outfall structures.

That lead to the idea to group outfalls together. It was determined that Outfalls 001 and 002 are in the same general location and could possibly utilizes a single storage/treatment facility. The storage facility according to the above analysis would have to store approximately 73,516,000 gallons of collected stormwater plus any precipitation that may fall within the open storage area. According to our analysis, the storage facility would need to be 29 acres. Sufficient land for the location of this facility is not available in the area.

The storage facility for Outfall 003 according to the above analysis would have to store approximately 111,630,000 gallons of collected stormwater plus any precipitation that may fall within the open storage area. According to our analysis, the storage facility would need to be 44 acres. Sufficient land for the location of this facility is not available in the area.

It was determined that Outfalls 004 through 007 are in the same general vicinity and could possibly utilizes a single storage/treatment facility. The storage facility according to the above analysis would have to store approximately 255,427,000 gallons of collected stormwater plus any precipitation that may fall within the open storage area. According to our analysis, the storage facility would need to be 101 acres. Sufficient land for the location of this facility is not available in the area.

A review was conducted of the 1999-2000 Discharge Monitoring Reports (DMR). Using the DMR data, an average BOD_5 was calculated for each of the storage treatment facilities and the results indicated that the BOD_5 were well below the SPDES discharge limitation for those outfalls. This analysis would indicate that there would be low food availability for the microorganisms to function adequately. In addition, the BOD_5 are already below the treatment level for the selected technologies. Therefore, it has been determined that collection and treatment of all stormwater from SHIA is inappropriate.

4.2 Conclusion

SHIA is continuing to implement additional measures to collect aircraft deicing fluid, and to improve existing measures. In this report, SHIA discussed its efforts to increase the effectiveness of the existing system. All of these efforts have improved the collection of contaminated runoff and further reduced the discharge of contaminated runoff to the environment.

The SHIA Consent Order required the City to implement the recommended methods for reducing contaminant runoff by November 1, 2001. The City has already implemented a number of structural and non-structural improvements to the SHIA system including a major upgrade of the runway surface monitoring system and expansion of the North and South Deicing Pads. In addition, the City has instituted numerous Best Management Practices to increase the effectiveness of the SHIA system. The effectiveness of the City's efforts to reduce discharge of contaminated runoff has been demonstrated in the reduction in the number and severity of SPDES permit exceedances.

4.2.a Additional Measures

Each of the three deicing pads and the snowmelt pad has a dedicated diversion structure associated with that facility. Any of the drainage from these facilities is discharged to its dedicated diversion structure. The flow in the diversion structure can be diverted either to the SHIA storm sewer system or to the glycol collection system. During the deicing season, flow is diverted to the glycol collection system. The flow entering the diversion structures during the non-deicing season will be diverted to the SHIA storm sewer system for ultimate discharge through one of the permitted SHIA Outfalls.

During the 2000-2001 deicing season, City personnel investigated the various diversion structures as a potential cause of fugitive glycol discharges. During the investigation, no glycol was observed bypassing the stop planks. As an additional precautionary measure, the City will install inflatable plugs downstream of the stop planks when the diversion structures are in glycol collection mode. Following the completion of the 2000-2001 deicing season, City personnel will investigate the structural integrity of the various diversion structures and will make modifications to ensure that the default mode will be "deicing collection" rather than "storm sewer mode".

In an effort to further reduce the potential for fugitive glycol, the City proposes to block the storm sewers using pneumatic plugs downstream of various catchbasins which are in the vicinity of the aircraft deicing pads to prevent the drainage from entering the stormwater system. City personnel will sample on an as needed basis the collected fluid and test it for glycol. The glycol test will be performed in the field using portable test kit. If the results of the test indicate an elevated glycol level, City personnel will pump the contents of the storm sewer to the nearest aircraft deicing pad. If the test does not indicate elevated glycol levels, the contents will be released to the storm sewer.

The following is a listing of preliminary storm sewer locations, which the City proposes to plug and monitor:

- Between locations C49 and C48 (West Deicing Pad)
- Between locations A34 and A33 (North Deicing Pad)
- Between locations A29 and A28 (Snow Melt Pad)
- Between locations F14A and F14 (South Deicing Pad)

The City will evaluate the effectiveness of these monitoring locations and if it is determined that fugitive glycol is not tributary to a particular locations, that monitoring location will be discontinued. If the City determines that additional monitoring locations are deemed necessary, the City is committed to monitoring those locations. The City will install the pneumatic plugs by October 31, 2001.

The City remains committed to evaluating the effectiveness of their existing system and to make adjustments to the system, if required, to continue to meet the SPDES permit requirements.

In addition, the City has approved funding for the construction of a fourth 2 million-gallon treatment lagoon. The City anticipates completion of construction prior to the 2002-2003 deicing season.

5.0 STREAM MACROINVERTEBRATES

A macroinvertebrate survey of North Branch Ley Creek (Ley Creek-NB), Mud Creek and Beartrap Creek in Onondaga County, New York was conducted. The survey was conducted on October 14-16, 1998, October 13-15, 1999, and October 11-13, 2000.

Ley Creek-NB and Mud Creek are both classified by the DEC as "Class C" with "C Standards". Beartrap Creek is classified as "Class C" with "C (T) Standards". Beartrap Creek is therefore a regulated stream, while the other two are not (6 NYCRR 895.4 and 899.4).

Ley Creek-NB flows in a southwest direction, skirting the SHIA and joining South Branch Ley Creek just south of the New York State Thruway (I-90). Mud Creek flows in a northerly direction starting at the northern edge of SHIA, eventually joining with the Oneida River. Beartrap Creek has its origins near the interchange of East Taft Road and Interstate 81 (I-81) and flows in a southerly direction, crossing to the east side of I-81 just south of Airport Boulevard and then flowing adjacent to I-81 until it also joins Ley Creek just south of I-90 (Figure 3).

The survey results presented here provide a baseline of data on the macroinvertebrate community structure and a preliminary assessment of the water quality of these three streams.

5.1 Methods

Stream macroinvertebrate were collected in accordance with procedures described in NYSDEC publications by Bode (1998) and Bode *et al.* (1996). At riffle areas a "traveling kick" sample of 5 minutes/5 meter duration, at a diagonal, bank-to-bank, downstream, was collected using an aquatic D-framed net. At slower flowing locations, the same aquatic net was used in a similar manner, except with a sweeping motion of the net if sufficient current was present.

Three samples were collected at each of the eight locations (Figure 3). Very few riffle areas exist on any of the three streams, and those that do are very limited in size. In many cases, one sample effort was sufficient to sample the entire riffle area. The remaining two samples were then collected just above the head or below the tail of the riffle section, or if possible, at another riffle area in the vicinity. As such, none of the three samples collected at any location should be considered replicates. The additional samples do, however, provide a more complete representation of the macroinvertebrate fauna present in these streams.

All organisms collected were preserved in the field in alcohol. A random subsample was then taken in the manner described by Bode *et al.* (1996). The resulting subsample of at least 100 organisms was then identified with the aid of keys in Harman and Berg (1971), Merrit and Cummins (1984) and Peckarsky *et al.* (1995).

At the time macroinvertebrate samples were collected and on a quarterly basis, stream physical and chemical data were also collected at each location. Stream width, depth, temperature, velocity, conductivity, pH and dissolved oxygen were measured.

Analysis of the macroinvertebrate data was conducted according to methods described in Bode *et al.* (1996). This included calculation of all pertinent macroinvertebrate community indices, and an assessment of overall water quality by plotting indices on a common scale of water quality impact, or Biological Assessment Profile.

5.2 Results

Sampling locations on Ley Creek-NB, Mud Creek and Beartrap Creek are shown in Figure 3. Location L-1 on Ley Creek-NB and Location BT-US on Beartrap Creek are located upstream of any possible runoff from the airport. The other locations are downstream of any potential airport runoff.

Physical and chemical measurements taken at each sample location are presented in Table 3. Most sample locations were shallow, with only Location L-1 and L-2 having depths greater than 2 feet. Widths vary from 1.5 feet to 25 feet. Current velocities were low at most locations. Only Location L-4 and BT-DS had velocities over 1.5 ft/sec. Temperatures ranged from 0^0 C to 21.5^0C. Dissolved oxygen values ranged from 3.23 ppm to 11.2 ppm, with the highest values at Location L-4 and BT-DS. These locations also had the highest current velocities. pH values ranged from 6.1 to 8.3. Conductivities ranged from 460 umhos/cm to 3100 unhos/cm. The highest conductivities occurred at Location BT-US and BT-DS.

A list of macroinvertebrate taxa and their percent occurrence at each sample location is presented in Tables 4 and 5. The most abundant organisms overall were the amphipod (scud) *Gammarus* and the isopod (aquatic sow bug) *Caecidotea*. Chironomid (aquatic midge fly) larvae were also numerous, especially at Location L-2 and Location M-2. Tubificidae (aquatic worms) were also relatively abundant overall. Location L-1, the most upstream location on Ley Creek-NB had large numbers of Corixidae (water boatmen bugs) in 1998. The Plecoptera (stoneflies) were completely absent from samples at all locations, and the Trichoptera (caddisflies) and Ephemeroptera (mayflies) were only sporadically represented.

Indices of macroinvertebrate community structure, as defined in Bode *et al.* (1996), were calculated for each sample taken at each location (Table 6, Table 7 and Table 8). The PMA (percent model affinity) index was calculated for the samples taken from riffle habitats, while the NCO index (number of taxa exclusive of chironomids and oligochaetes) were determined for samples from slow, sandy/silty locations. The remaining indices were calculated for all samples. The Biological Assessment Profiles (BAP) of index values for riffle habitats, and for net samples from slow, sandy/silty streams, were used to convert the index values to a common scale of water quality impact. These normalized values are indicated in brackets ( ) next to each of the raw index values. The WQS (water quality scale) value in the mean of all normalized index values (12 values) for each location.

The WQS means were plotted on the common scale of water quality (Figure 4, Figure 5 and Figure 6). Figure 4 shows the plot of the means for each of the four sampling locations on Ley Creek-NB for 1998, 1999, and 2000. All plotted points, except that for 1999 at L-4, fall within the "moderate" water quality impact region. Mud Creek WQS means are plotted in Figure 5. Location M-1 is in the upper (less severe) "severe impact" portion of the scale, while Location M-2 is within the "moderate impact" region. Beartrap Creek WQS mean values for location BT-US, and location BT-DS, fall within the "moderate impact" portion of the scale, with little difference between the upstream and downstream locations, or between sampling years.

Although the October 1999 sampling occurred shortly after the end of a drought season (National Weather Service reported a 5.8 inch deficit in precipitation between January 1, 1999 and October 1, 1999 for Onondaga County), this was reflected only in some lower water depths and stream widths at some of the sample locations. While some differences in WQS values can be seen between 1998 and 1999 (for example at Location L-3 and M-2, Figure 4 and Figure 5), variation occurring within the range of any one impact category (severe, moderate, slight or none) should, in most instances, not be considered significant. Mud Creek and Beartrap Creek each had nearly identical WQS values for the 1998 and 2000 sample years (Figure 5 and Figure 6).

During the October 2000 sampling, Locations M-2 on Mud Creek, and BT-DS on Beartrap Creek were flooded to a level that covered previously exposed rock and rubble, and in the case of M-2, reduced the current velocity significantly. The cause of flooding at BT-DS was not determined, but the flooding at M-2 was caused by a recent constructed beaver dam approximately 300 yards downstream. The WQS values for these locations did not reflect any changes in water quality that might have been caused by this flooding.

5.3 Discussion

Ideal, healthy (that is, diverse, stable and productive) macroinvertebrate communities exist in streams that receive no pollution; that have cold, clear, well-oxygenated water; that persist throughout the year; and that provide numerous riffle habitats with abundant substrate niches (for example, cobbles, boulders, submerged logs) for the organisms to live in, under, or on. Such streams typically have a large number of species of mayflies, stoneflies and caddisflies, and have no one species, or group of organisms, excessively dominant. Each of the five indices calculated here provides a different numerical measure of the similarity of each macroinvertebrate community sampled, to such an ideal community. The indices are therefore adjusted to a common scale (WQS), based on Biological Assessment Profiles, which are empirically derived from a database of state-wide surveys of clean water as well as polluted streams (Bode *et al.* 1996). The average of the normalized equivalents of each of these indices provides an overall assessment of the water quality at each of the sample locations (Figure 4, Figure 5 and Figure 6).

All locations except M-1 on Mud Creek (1998, 1999, and 2000), and L-4 on Ley Creek-NB (1999 only), have WQS values that fall in the "moderate" impact region of the water quality scale. Location M-1 falls in the "severe" impact region, as does L-4 in 1999. However, numerous factors other than actual pollution, whether point source or non-point source, toxic or organic enriched, can affect the values obtained for any of the indices calculated here. A variety of naturally occurring factors, both physical and chemical can alter the species composition and productivity of a stream. Certain combinations of these factors produce streams that have a diverse and highly productive macroinvertebrate fauna, while others produce less than ideal conditions for establishment of such "healthy" communities.

Issues of possible pollution aside, none of the three streams sampled here provide physical conditions that would be conductive to establishment of such an ideal macroinvertebrate community. All three streams flow through an area of very flat topography, with little gradient along the stream courses (Figure 3). Water velocities are low, and long portions of these streams exhibit lentic (or ponded) water characteristics with regard to current velocity, bottom substrate, and the macro invertebrate species assemblages found there.

These three streams, throughout most of their lengths, flow through areas of concentrated industrial, commercial, or residential land use. Large portions of these streams have been channelized and riffle areas eliminated. Natural stream bank buffer zones are limited. Land clearing, right to the stream banks, has removed shade cover and probably contributes to high water temperatures during the summer months. Pavement or mowed lawns encroach on the stream channels, in some cases right to the water's edge. Portions of Ley Creek-NB and Beartrap Creek have been underground. There is visible evidence of point-source pollution. These factors all add up to a generally degraded habitat for stream macroinvertebrate.

These man-made alternations to the natural stream physiography, and the municipal/industrial nature of the adjacent land use, are probably sufficient to explain the overall water quality impact assessment obtained in this study. The input into these streams of nutrient loadings (from residential areas), road salt and silt runoff, and other substances from numerous industrial and commercial sources could be additional contributing factors to the overall "moderate impact" assessment, and in the case of Location M-1, the one "severe" impact assessment. The impact of road salt runoff, for example, can be seen in the high conductivity levels on Beartrap Creek, both upstream of the airport as well as downstream of it.

No clear differences in water quality impact assessment of Ley Creek-NB could be seen between the location upstream of the SHIA (L-1) and those downstream (L-2, L-3 and L-4). Locations L-3 and L-4 showed somewhat opposite WQS values between 1998 and 1999 (Figure 4) although as stated above, differences of this magnitude are probably not significant. Mud Creek sample locations were both located downstream of SHIA as there is no portion of the creek located upstream of SHIA. Location M-1, which is upstream of Location M-2, was evaluated during all three years in the "severe" portion of the water quality scale, while Location M-2 fell in the "moderate" region of the scale. The character of the stream changes dramatically between these locations, however, so comparison is difficult. The woodland stream characteristics of Location M-2 however, would be expected to provide a better habitat for macroinvertebrates than the drainage swale characteristics of Location M-1, and this appears to be reflected in the higher WQS values for Location M-2. Water quality impact assessment for Beartrap Creek was nearly identical during all three years for the location upstream of SHIA (BT-US) and that downstream of it (BT-DS), and fell entirely within the moderate impact region of the scale (Figure 6).

6.0 TISSUE ANALYSIS

In conjunction with the stream macroinvertebrate survey and collection of data on physical and chemical characteristics of the three streams mentioned in the previous section, a tissue collection and chemical analysis program was also conducted in 1998, 1999, and 2000. This survey was also conducted as a condition of the consent order between the City of Syracuse and the NYSDEC.

The sampling locations for tissue collection were the same as those used in the macroinvertebrate survey, and are shown on Figure 3.

6.1 Methods

Sampling was conducted between the following dates.

October 14 - 25, 1998
October 13 - 25, 1999
October 11, 2000 - January 26, 2001

Target organisms for tissue analysis were crayfish and species of small fish. Sampling was conducted using dip nets and hand capture, and by setting baited minnow traps which were then checked on a daily basis.

Crayfish and fish samples were rinsed in stream water, bagged for separate analysis in aluminum foil and plastic bags, and then frozen. When a sufficient weight of animals was collected, sampling was suspended at the location. Sampling continued at each location until enough tissue was collected, or until it was obvious that a sufficient sample was not obtainable. Table 9 indicated the sampling stations at which sufficient samples (that is, enough material) were collected in each year.

Samples were hand-delivered to Life Science Laboratories, Inc. in East Syracuse, New York for analysis. Parameters analyzed for were:

EPA 160.0 - Total Solids
EPA 6010 - Priority Pollutant Metals
EPA 7471 - Mercury
EPA 8082 - PCB's
EPA 8310 - PAHs

The results of the laboratory analyses were then compared to "concentrations considered provisionally to constitute levels of concern in tissues of selected macroinvertebrate" (Bode *et al.* 1996), and guidance values for minnows provided by the NYSDEC for this study only.

6.2 Results

Twenty-eight samples (11 fish samples, 18 crayfish samples) were collected and analyzed (Table 9). The crayfish samples consisted of multiple individuals of the crayfish. *Orconectes propinquus*. Fish samples were variable composites of the following species of fish:

Common carp	*Cyprinus carpio*
Common shiner	*Notropis cornutus*
Brook stickleback	*Culaea inconstans*
Pumpkinseed	*Lepomis gibbosus*
Tessellated darter	*Etheostoma olmstedi*

The full laboratory analysis reports can be found in Appendix B, and the provisional levels of concern provided by the NYSDEC are found in Appendix C. Table 10 is a summary of the data where analysis revealed tissue samples that exceeded the provisional levels of concern for the particular metal or compound. The table illustrates: by compound, by year, and by type of sample, the variability obtained from the analyses. Only those metals or compounds for which at least one sample exceeded levels of concern are included in this table.

A variety of metals exceed NYSDEC levels of concern, with selenium being the most often observed to be exceeded. All of the polycyclic aromatic hydrocarbons tested for are exceeded in tissue samples at least twice, with benzo(a)anthracene being exceeded more than any other compound. None of the sample tests exceeded levels of concern for PCBs.

6.3 Discussion

Table 11 summarizes the number of samples, by sampling location, in which the tissue analysis exceeds the NYSDEC level of concern for a particular metal or for PAHs. Only sampling locations L-1 on Ley Creek and BT-US on Beartrap Creek are upstream of any possible runoff from Syracuse Hancock International Airport.

A comparison of metal exceedances of these two upstream sampling locations to all the possible downstream locations shown no real pattern in the distribution of metals exceeding NYSDEC levels of concern. Six PAH were observed to exceed the level of concern in two of eight samples in these upstream locations, whereas 34 PAH analysis exceed levels of concern in the 21 samples taken at the remaining sampling locations.

7.0 REFERENCES

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Peckarsky, B.L., P.R. Fraissinet, M.A. Penton, and D.J. Conklin, Jr. 1990. Freshwater Macroinvertebrates of Northeastern North America. Comstock Publishing Associates, Cornell University Press, Ithaca, New York, 442 pp.

Tissue Analysis – 1998

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Tony Longo
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-2
Project No.:
Source:
LSL Sample ID: 9806851-006
Sample Matrix: Crayfish,Dry Wt

Authorization:
LSL Project No.: 9806851
Date Sampled: 10/22/98
Report Date: 11/16/98

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	27	%	11/10/98	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	2.3	mg/kg dry	11/13/98	
Cadmium	<0.4	mg/kg dry	11/13/98	
Chromium	1.7	mg/kg dry	11/13/98	
Copper	140	mg/kg dry	11/13/98	
Lead	2.3	mg/kg dry	11/13/98	(17)
(17) A duplicate analysis of this result was found to be slightly beyond statistical control limits.				
Nickel	1.1	mg/kg dry	11/13/98	
Selenium	<2	mg/kg dry	11/13/98	
Titanium	8.0	mg/kg dry	11/13/98	
Zinc	89	mg/kg dry	11/13/98	
EPA 7471 Mercury (Dry Wt.)				
Mercury	<0.07	mg/kg dry	11/16/98	
EPA 8082 PCB's (Dry Wt.)				
Arochlor-1016	<0.07	mg/kg dry	11/13/98	
Arochlor-1221	<0.07	mg/kg dry	11/13/98	
Arochlor-1232	<0.07	mg/kg dry	11/13/98	
Arochlor-1242	<0.07	mg/kg dry	11/13/98	
Arochlor-1248	<0.07	mg/kg dry	11/13/98	
Arochlor-1254	<0.07	mg/kg dry	11/13/98	
Arochlor-1260	<0.07	mg/kg dry	11/13/98	
EPA 8310 PAH (Dry Wt.)				
Chrysene	0.66	mg/kg dry	11/15/98	
Fluoranthene	<0.1	mg/kg dry	11/15/98	
Phenanthrene	<0.1	mg/kg dry	11/15/98	
Pyrene	1.2	mg/kg dry	11/15/98	
Benzo(a)anthracene	2.4	mg/kg dry	11/15/98	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Tony Longo
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-3
Project No.:
Source:
LSL Sample ID: 9806851-005
Sample Matrix: Crayfish,Dry Wt

Authorization:
LSL Project No.: 9806851
Date Sampled: 10/22/98
Report Date: 11/16/98

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	28	%	11/10/98	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	2.8	mg/kg dry	11/13/98	
Cadmium	<0.4	mg/kg dry	11/13/98	
Chromium	1.5	mg/kg dry	11/13/98	
Copper	62	mg/kg dry	11/13/98	
Lead	1.4	mg/kg dry	11/13/98	
Nickel	1.4	mg/kg dry	11/13/98	
Selenium	<2	mg/kg dry	11/13/98	
Titanium	11	mg/kg dry	11/13/98	
Zinc	55	mg/kg dry	11/13/98	
EPA 7471 Mercury (Dry Wt.)				
Mercury	<0.06	mg/kg dry	11/16/98	
EPA 8082 PCB's (Dry Wt.)				
Arochlor-1016	<0.07	mg/kg dry	11/13/98	
Arochlor-1221	<0.07	mg/kg dry	11/13/98	
Arochlor-1232	<0.07	mg/kg dry	11/13/98	
Arochlor-1242	<0.07	mg/kg dry	11/13/98	
Arochlor-1248	<0.07	mg/kg dry	11/13/98	
Arochlor-1254	<0.07	mg/kg dry	11/13/98	
Arochlor-1260	<0.07	mg/kg dry	11/13/98	
EPA 8310 PAH (Dry Wt.)				
Chrysene	0.72	mg/kg dry	11/15/98	
Fluoranthene	<0.1	mg/kg dry	11/15/98	
Phenanthrene	<0.1	mg/kg dry	11/15/98	
Pyrene	0.25	mg/kg dry	11/15/98	
Benzo(a)anthracene	0.17	mg/kg dry	11/15/98	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Tony Longo
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-4
Project No.:
Source:
LSL Sample ID: 9806851-002
Sample Matrix: Crayfish,Dry Wt

Authorization:
LSL Project No.: 9806851
Date Sampled: 10/21/98
Report Date: 11/16/98

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	28	%	11/10/98	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	2.5	mg/kg dry	11/13/98	
Cadmium	<0.3	mg/kg dry	11/13/98	
Chromium	1.2	mg/kg dry	11/13/98	
Copper	140	mg/kg dry	11/13/98	
Lead	1.7	mg/kg dry	11/13/98	(17)
(17) A duplicate analysis of this result was found to be slightly beyond statistical control limits.				
Nickel	0.87	mg/kg dry	11/13/98	
Selenium	<2	mg/kg dry	11/13/98	
Titanium	6.3	mg/kg dry	11/13/98	
Zinc	79	mg/kg dry	11/13/98	
EPA 7471 Mercury (Dry Wt.)				
Mercury	<0.04	mg/kg dry	11/16/98	
EPA 8082 PCB's (Dry Wt.)				
Arochlor-1016	<0.07	mg/kg dry	11/13/98	
Arochlor-1221	<0.07	mg/kg dry	11/13/98	
Arochlor-1232	<0.07	mg/kg dry	11/13/98	
Arochlor-1242	<0.07	mg/kg dry	11/13/98	
Arochlor-1248	<0.07	mg/kg dry	11/13/98	
Arochlor-1254	<0.07	mg/kg dry	11/13/98	
Arochlor-1260	<0.07	mg/kg dry	11/13/98	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	11/15/98	
Fluoranthene	<0.1	mg/kg dry	11/15/98	
Phenanthrene	<0.1	mg/kg dry	11/15/98	
Pyrene	0.76	mg/kg dry	11/15/98	
Benzo(a)anthracene	0.45	mg/kg dry	11/15/98	

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C&S Engineers, Inc.
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Attn: Tony Longo
Phone: (315) 455-2000
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Sample ID: M-1
Project No.:
Source:
LSL Sample ID: 9806851-004
Sample Matrix: Crayfish,Dry Wt

Authorization:
LSL Project No.: 9806851
Date Sampled: 10/21/98
Report Date: 11/16/98

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	30	%	11/10/98	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	1.6	mg/kg dry	11/13/98	
Cadmium	<0.4	mg/kg dry	11/13/98	
Chromium	1.0	mg/kg dry	11/13/98	
Copper	56	mg/kg dry	11/13/98	
Lead	1.4	mg/kg dry	11/13/98	(17)
(17) A duplicate analysis of this result was found to be slightly beyond statistical control limits.				
Nickel	1.2	mg/kg dry	11/13/98	
Selenium	<2	mg/kg dry	11/13/98	
Titanium	4.0	mg/kg dry	11/13/98	
Zinc	75	mg/kg dry	11/13/98	
EPA 7471 Mercury (Dry Wt.)				
Mercury	<0.06	mg/kg dry	11/16/98	

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C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Tony Longo
Phone: (315) 455-2000
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Sample ID: M-2
Project No.:
Source:
LSL Sample ID: 9806851-003
Sample Matrix: Crayfish,Dry Wt

Authorization:
LSL Project No.: 9806851
Date Sampled: 10/21/98
Report Date: 11/16/98

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	29	%	11/10/98	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	1.9	mg/kg dry	11/13/98	
Cadmium	<0.3	mg/kg dry	11/13/98	
Chromium	1.3	mg/kg dry	11/13/98	
Copper	110	mg/kg dry	11/13/98	
Lead	4.3	mg/kg dry	11/13/98	(17)
(17) *A duplicate analysis of this result was found to be slightly beyond statistical control limits.*				
Nickel	1.5	mg/kg dry	11/13/98	
Selenium	<2	mg/kg dry	11/13/98	
Titanium	6.3	mg/kg dry	11/13/98	
Zinc	77	mg/kg dry	11/13/98	
EPA 7471 Mercury (Dry Wt.)				
Mercury	<0.07	mg/kg dry	11/16/98	
EPA 8082 PCB's (Dry Wt.)				
Arochlor-1016	<0.07	mg/kg dry	11/13/98	
Arochlor-1221	<0.07	mg/kg dry	11/13/98	
Arochlor-1232	<0.07	mg/kg dry	11/13/98	
Arochlor-1242	<0.07	mg/kg dry	11/13/98	
Arochlor-1248	<0.07	mg/kg dry	11/13/98	
Arochlor-1254	<0.07	mg/kg dry	11/13/98	
Arochlor-1260	<0.07	mg/kg dry	11/13/98	
EPA 8310 PAH (Dry Wt.)				
Chrysene	1.3	mg/kg dry	11/15/98	
Fluoranthene	<0.1	mg/kg dry	11/15/98	
Phenanthrene	<0.1	mg/kg dry	11/15/98	
Pyrene	<0.1	mg/kg dry	11/15/98	
Benzo(a)anthracene	<0.07	mg/kg dry	11/15/98	

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C&S Engineers, Inc.
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Attn: Tony Longo
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: BT-DS
Project No.:
Source:
LSL Sample ID: 9806851-001
Sample Matrix: Crayfish,Dry Wt

Authorization:
LSL Project No.: 9806851
Date Sampled: 10/21/98
Report Date: 11/16/98

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	30	%	11/10/98	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	1.6	mg/kg dry	11/13/98	
Cadmium	<0.3	mg/kg dry	11/13/98	
Chromium	1.3	mg/kg dry	11/13/98	
Copper	100	mg/kg dry	11/13/98	
Lead	4.3	mg/kg dry	11/13/98	(17)
(17) *A duplicate analysis of this result was found to be slightly beyond statistical control limits.*				
Nickel	1.4	mg/kg dry	11/13/98	
Selenium	<2	mg/kg dry	11/13/98	
Titanium	6.2	mg/kg dry	11/13/98	
Zinc	88	mg/kg dry	11/13/98	
EPA 7471 Mercury (Dry W.t)				
Mercury	<0.06	mg/kg dry	11/16/98	
EPA 8082 PCB's (Dry Wt.)				
Arochlor-1016	<0.07	mg/kg dry	11/13/98	
Arochlor-1221	<0.07	mg/kg dry	11/13/98	
Arochlor-1232	<0.07	mg/kg dry	11/13/98	
Arochlor-1242	<0.07	mg/kg dry	11/13/98	
Arochlor-1248	<0.07	mg/kg dry	11/13/98	
Arochlor-1254	<0.07	mg/kg dry	11/13/98	
Arochlor-1260	<0.07	mg/kg dry	11/13/98	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	11/15/98	
Fluoranthene	<0.1	mg/kg dry	11/15/98	
Phenanthrene	<0.1	mg/kg dry	11/15/98	
Pyrene	<0.1	mg/kg dry	11/15/98	
Benzo(a)anthracene	8.2	mg/kg dry	11/15/98	

Tissue Analysis - 1999

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: M-1 FISH
Project No.:
Source:
LSL Sample ID: 9908636-006
Sample Matrix: SHW, Dry Wt.

Authorization:
LSL Project No.: 9908636
Date Sampled: 10/13/99
Report Date: 11/29/99

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	19	%	11/11/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<0.5	mg/kg dry	11/12/99	
Cadmium	<0.5	mg/kg dry	11/12/99	
Chromium	0.59	mg/kg dry	11/12/99	
Copper	7.6	mg/kg dry	11/12/99	
Lead	<0.5	mg/kg dry	11/12/99	
Nickel	<0.5	mg/kg dry	11/12/99	
Selenium	21	mg/kg dry	11/12/99	
Titanium	<5	mg/kg dry	11/12/99	
Zinc	170	mg/kg dry	11/12/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.1	mg/kg dry	11/15/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	11/16/99	
Aroclor-1221	<0.1	mg/kg dry	11/16/99	
Aroclor-1232	<0.1	mg/kg dry	11/16/99	
Aroclor-1242	<0.1	mg/kg dry	11/16/99	
Aroclor-1248	<0.1	mg/kg dry	11/16/99	
Aroclor-1254	<0.1	mg/kg dry	11/16/99	
Aroclor-1260	<0.1	mg/kg dry	11/16/99	
EPA 8310 PAH				
Chrysene	0.20	mg/kg dry	11/20/99	
Fluoranthene	<0.1	mg/kg dry	11/20/99	
Phenanthrene	0.19	mg/kg dry	11/20/99	
Pyrene	<0.1	mg/kg dry	11/20/99	
Benzo(a)anthracene	<0.07	mg/kg dry	11/20/99	

Life Science Laboratories, Inc.
5854 Butternut Drive, East Syracuse, New York 13057 Telephone: (315) 445-1105 Telefax: (315) 445-1301
NYS DOH ELAP No. 10248

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: BT-US FISH
Project No.:
Source:
LSL Sample ID: 9908636-007
Sample Matrix: SHW, Dry Wt.

Authorization:
LSL Project No.: 9908636
Date Sampled: 10/19/99
Report Date: 11/29/99

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	21	%	11/11/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<0.4	mg/kg dry	11/12/99	
Cadmium	<0.4	mg/kg dry	11/12/99	
Chromium	0.55	mg/kg dry	11/12/99	
Copper	18	mg/kg dry	11/12/99	
Lead	<0.4	mg/kg dry	11/12/99	
Nickel	0.50	mg/kg dry	11/12/99	
Titanium	<4	mg/kg dry	11/12/99	
Selenium	18	mg/kg dry	11/12/99	
Zinc	120	mg/kg dry	11/12/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.07	mg/kg dry	11/15/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	11/16/99	
Aroclor-1221	<0.1	mg/kg dry	11/16/99	
Aroclor-1232	<0.1	mg/kg dry	11/16/99	
Aroclor-1242	<0.1	mg/kg dry	11/16/99	
Aroclor-1248	<0.1	mg/kg dry	11/16/99	
Aroclor-1254	<0.1	mg/kg dry	11/16/99	
Aroclor-1260	<0.1	mg/kg dry	11/16/99	
EPA 8310 PAH				
Chrysene	<0.04	mg/kg dry	11/20/99	
Fluoranthene	<0.1	mg/kg dry	11/20/99	
Phenanthrene	<0.1	mg/kg dry	11/20/99	
Pyrene	<0.1	mg/kg dry	11/20/99	
Benzo(a)anthracene	<0.07	mg/kg dry	11/20/99	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: BT-DS FISH

Project No.:
Source:
LSL Sample ID: 9908636-008
Sample Matrix: SHW, Dry Wt.

Authorization:
LSL Project No.: 9908636
Date Sampled: 10/14/99
Report Date: 11/29/99

Analytical Method / Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	25	%	11/11/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<0.4	mg/kg dry	11/12/99	
Cadmium	<0.4	mg/kg dry	11/12/99	
Chromium	0.80	mg/kg dry	11/12/99	
Copper	91	mg/kg dry	11/12/99	
Lead	<0.4	mg/kg dry	11/12/99	
Nickel	<0.4	mg/kg dry	11/12/99	
Titanium	<4	mg/kg dry	11/12/99	
Selenium	24	mg/kg dry	11/12/99	
Zinc	250	mg/kg dry	11/12/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.08	mg/kg dry	11/15/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	11/16/99	
Aroclor-1221	<0.1	mg/kg dry	11/16/99	
Aroclor-1232	<0.1	mg/kg dry	11/16/99	
Aroclor-1242	<0.1	mg/kg dry	11/16/99	
Aroclor-1248	<0.1	mg/kg dry	11/16/99	
Aroclor-1254	<0.1	mg/kg dry	11/16/99	
Aroclor-1260	<0.1	mg/kg dry	11/16/99	
EPA 8310 PAH				
Chrysene	<0.04	mg/kg dry	11/20/99	
Fluoranthene	1.6	mg/kg dry	11/20/99	
Phenanthrene	<0.1	mg/kg dry	11/20/99	
Pyrene	<0.1	mg/kg dry	11/20/99	
Benzo(a)anthracene	0.31	mg/kg dry	11/20/99	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-1 CRAYFISH
Project No.:
Source:
LSL Sample ID: 9908636-001
Sample Matrix: SHW, Dry Wt.

Authorization:
LSL Project No.: 9908636
Date Sampled: 10/19/99
Report Date: 11/29/99

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	26	%	11/11/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<0.4	mg/kg dry	11/12/99	
Cadmium	<0.4	mg/kg dry	11/12/99	
Chromium	<0.4	mg/kg dry	11/12/99	
Copper	36	mg/kg dry	11/12/99	
Lead	<0.4	mg/kg dry	11/12/99	
Nickel	1.1	mg/kg dry	11/12/99	
Selenium	17	mg/kg dry	11/12/99	
Titanium	<4	mg/kg dry	11/12/99	
Zinc	58	mg/kg dry	11/12/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.06	mg/kg dry	11/15/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	11/16/99	
Aroclor-1221	<0.1	mg/kg dry	11/16/99	
Aroclor-1232	<0.1	mg/kg dry	11/16/99	
Aroclor-1242	<0.1	mg/kg dry	11/16/99	
Aroclor-1248	<0.1	mg/kg dry	11/16/99	
Aroclor-1254	<0.1	mg/kg dry	11/16/99	
Aroclor-1260	<0.1	mg/kg dry	11/16/99	
EPA 8310 PAH				
Chrysene	<0.04	mg/kg dry	11/19/99	
Fluoranthene	<0.1	mg/kg dry	11/19/99	
Phenanthrene	<0.1	mg/kg dry	11/19/99	
Pyrene	<0.1	mg/kg dry	11/19/99	
Benzo(a)anthracene	<0.07	mg/kg dry	11/19/99	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Tony Long
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-1F
Project No.:
Source:
LSL Sample ID: 9900482-002
Sample Matrix: Fish

Authorization:
LSL Project No.: 9900482
Date Sampled: 10/28/98
Report Date: 3/1/99

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	22	%	2/9/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<1	mg/kg dry	2/15/99	
Cadmium	<1	mg/kg dry	2/15/99	
Chromium	15	mg/kg dry	2/15/99	
Copper	14	mg/kg dry	2/15/99	
Lead	0.96	mg/kg dry	2/15/99	
Nickel	15	mg/kg dry	2/15/99	
Titanium	<10	mg/kg dry	2/15/99	
Selenium	14	mg/kg dry	2/15/99	
Zinc	140	mg/kg dry	2/15/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.5	mg/kg dry	2/11/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Arochlor-1016	<0.1	mg/kg dry	2/23/99	
Arochlor-1221	<0.1	mg/kg dry	2/23/99	
Arochlor-1232	<0.1	mg/kg dry	2/23/99	
Arochlor-1242	<0.1	mg/kg dry	2/23/99	
Arochlor-1248	<0.1	mg/kg dry	2/23/99	
Arochlor-1254	<0.1	mg/kg dry	2/23/99	
Arochlor-1260	<0.1	mg/kg dry	2/23/99	
EPA 8310 PAH				
Chrysene	<0.001	mg/kg dry	2/26/99	
Fluoranthene	<0.001	mg/kg dry	2/26/99	
Phenanthrene	<0.001	mg/kg dry	2/26/99	
Pyrene	<0.001	mg/kg dry	2/26/99	
Benzo(a)anthracene	<0.001	mg/kg dry	2/26/99	

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Attn: Tony Long
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: M-1F
Project No.:
Source:
LSL Sample ID: 9900482-001
Sample Matrix: Fish

Authorization:
LSL Project No.: 9900482
Date Sampled: 10/28/99 1998 SAMPLE
Report Date: 3/1/99

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	23	%	2/9/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	10.0	mg/kg dry	2/15/99	
Cadmium	<0.9	mg/kg dry	2/15/99	
Chromium	1.5	mg/kg dry	2/15/99	
Copper	14	mg/kg dry	2/15/99	
Lead	<0.9	mg/kg dry	2/15/99	
Nickel	<0.9	mg/kg dry	2/15/99	
Titanium	<9	mg/kg dry	2/15/99	
Selenium	12	mg/kg dry	2/15/99	
Zinc	190	mg/kg dry	2/15/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.4	mg/kg dry	2/11/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Arochlor-1016	<0.1	mg/kg dry	2/23/99	
Arochlor-1221	<0.1	mg/kg dry	2/23/99	
Arochlor-1232	<0.1	mg/kg dry	2/23/99	
Arochlor-1242	<0.1	mg/kg dry	2/23/99	
Arochlor-1248	<0.1	mg/kg dry	2/23/99	
Arochlor-1254	<0.1	mg/kg dry	2/23/99	
Arochlor-1260	<0.1	mg/kg dry	2/23/99	
EPA 8310 PAH				
Chrysene	<0.001	mg/kg dry	2/26/99	
Fluoranthene	<0.001	mg/kg dry	2/26/99	
Phenanthrene	<0.001	mg/kg dry	2/26/99	
Pyrene	0.0012	mg/kg dry	2/26/99	
Benzo(a)anthracene	<0.001	mg/kg dry	2/26/99	

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Attn: Tony Long
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: BT-US-F
Project No.:
Source:
LSL Sample ID: 9900482-003
Sample Matrix: Fish

Authorization:
LSL Project No.: 9900482
Date Sampled: 10/28/98
Report Date: 3/1/99

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	23	%	2/9/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<0.8	mg/kg dry	2/15/99	
Cadmium	<0.8	mg/kg dry	2/15/99	
Chromium	3.9	mg/kg dry	2/15/99	
Copper	34	mg/kg dry	2/15/99	
Lead	<0.8	mg/kg dry	2/15/99	
Nickel	1.5	mg/kg dry	2/15/99	
Titanium	<8	mg/kg dry	2/15/99	
Selenium	7.6	mg/kg dry	2/15/99	
Zinc	130	mg/kg dry	2/15/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.4	mg/kg dry	2/11/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Arochlor-1016	<0.1	mg/kg dry	2/23/99	
Arochlor-1221	<0.1	mg/kg dry	2/23/99	
Arochlor-1232	<0.1	mg/kg dry	2/23/99	
Arochlor-1242	<0.1	mg/kg dry	2/23/99	
Arochlor-1248	<0.1	mg/kg dry	2/23/99	
Arochlor-1254	<0.1	mg/kg dry	2/23/99	
Arochlor-1260	<0.1	mg/kg dry	2/23/99	
EPA 8310 PAH				
Chrysene	<0.001	mg/kg dry	2/26/99	
Fluoranthene	<0.001	mg/kg dry	2/26/99	
Phenanthrene	<0.001	mg/kg dry	2/26/99	
Pyrene	0.0019	mg/kg dry	2/26/99	
Benzo(a)anthracene	0.0016	mg/kg dry	2/26/99	

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Attn: Tony Longo
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-1
Project No.:
Source:
LSL Sample ID: 9806851-007
Sample Matrix: Crayfish,Dry Wt

Authorization:
LSL Project No.: 9806851
Date Sampled: 10/22/98
Report Date: 11/16/98

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	26	%	11/10/98	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	3.0	mg/kg dry	11/13/98	
Cadmium	<0.4	mg/kg dry	11/13/98	
Chromium	1.2	mg/kg dry	11/13/98	
Copper	81	mg/kg dry	11/13/98	
Lead	2.0	mg/kg dry	11/13/98	(17)
(17) *A duplicate analysis of this result was found to be slightly beyond statistical control limits.*				
Nickel	1.5	mg/kg dry	11/13/98	
Selenium	<2	mg/kg dry	11/13/98	
Titanium	9.2	mg/kg dry	11/13/98	
Zinc	65	mg/kg dry	11/13/98	
EPA 7471 Mercury (Dry Wt.)				
Mercury	<0.06	mg/kg dry	11/16/98	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	11/15/98	
Fluoranthene	<0.1	mg/kg dry	11/15/98	
Phenanthrene	<0.1	mg/kg dry	11/15/98	
Pyrene	<0.1	mg/kg dry	11/15/98	
Benzo(a)anthracene	0.29	mg/kg dry	11/15/98	

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C&S Engineers, Inc.
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N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-2 CRAYFISH

Project No.:

Source:

LSL Sample ID: 9908636-002

Sample Matrix: SHW, Dry Wt.

Authorization:

LSL Project No.: 9908636

Date Sampled: 10/21/99

Report Date: 11/29/99

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	30	%	11/11/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<0.3	mg/kg dry	11/12/99	
Cadmium	<0.3	mg/kg dry	11/12/99	
Chromium	1.0	mg/kg dry	11/12/99	
Copper	99	mg/kg dry	11/12/99	
Lead	0.77	mg/kg dry	11/12/99	
Nickel	1.1	mg/kg dry	11/12/99	
Selenium	18	mg/kg dry	11/12/99	
Titanium	1.2	mg/kg dry	11/12/99	
Zinc	74	mg/kg dry	11/12/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.05	mg/kg dry	11/15/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	11/16/99	
Aroclor-1221	<0.1	mg/kg dry	11/16/99	
Aroclor-1232	<0.1	mg/kg dry	11/16/99	
Aroclor-1242	<0.1	mg/kg dry	11/16/99	
Aroclor-1248	<0.1	mg/kg dry	11/16/99	
Aroclor-1254	<0.1	mg/kg dry	11/16/99	
Aroclor-1260	<0.1	mg/kg dry	11/16/99	
EPA 8310 PAH				
Chrysene	0.083	mg/kg dry	11/19/99	
Fluoranthene	0.36	mg/kg dry	11/19/99	
Phenanthrene	<0.1	mg/kg dry	11/19/99	
Pyrene	0.49	mg/kg dry	11/19/99	
Benzo(a)anthracene	0.28	mg/kg dry	11/19/99	

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Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-3 CRAYFISH

Project No.:
Source:
LSL Sample ID: 9908636-003
Sample Matrix: SHW, Dry Wt.

Authorization:
LSL Project No.: 9908636
Date Sampled: 10/19/99
Report Date: 11/29/99

Analytical Method / Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	32	%	11/11/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<0.3	mg/kg dry	11/12/99	
Cadmium	<0.3	mg/kg dry	11/12/99	
Chromium	0.65	mg/kg dry	11/12/99	
Copper	110	mg/kg dry	11/12/99	
Lead	0.32	mg/kg dry	11/12/99	
Nickel	0.79	mg/kg dry	11/12/99	
Titanium	<3	mg/kg dry	11/12/99	
Selenium	14	mg/kg dry	11/12/99	
Zinc	55	mg/kg dry	11/12/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.04	mg/kg dry	11/15/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	11/16/99	
Aroclor-1221	<0.1	mg/kg dry	11/16/99	
Aroclor-1232	<0.1	mg/kg dry	11/16/99	
Aroclor-1242	<0.1	mg/kg dry	11/16/99	
Aroclor-1248	<0.1	mg/kg dry	11/16/99	
Aroclor-1254	<0.1	mg/kg dry	11/16/99	
Aroclor-1260	<0.1	mg/kg dry	11/16/99	
EPA 8310 PAH				
Chrysene	<0.04	mg/kg dry	11/20/99	
Fluoranthene	0.25	mg/kg dry	11/20/99	
Phenanthrene	<0.1	mg/kg dry	11/20/99	
Pyrene	<0.1	mg/kg dry	11/20/99	
Benzo(a)anthracene	0.23	mg/kg dry	11/20/99	

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Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-4 CRAYFISH
Project No.:
Source:
LSL Sample ID: 9908636-004
Sample Matrix: SHW, Dry Wt.

Authorization:
LSL Project No.: 9908636
Date Sampled: 10/14/99
Report Date: 11/29/99

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	32	%	11/11/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<0.3	mg/kg dry	11/12/99	
Cadmium	<0.3	mg/kg dry	11/12/99	
Chromium	0.60	mg/kg dry	11/12/99	
Copper	74	mg/kg dry	11/12/99	
Lead	<0.3	mg/kg dry	11/12/99	
Nickel	0.94	mg/kg dry	11/12/99	
Selenium	16	mg/kg dry	11/12/99	
Titanium	<3	mg/kg dry	11/12/99	
Zinc	67	mg/kg dry	11/12/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	0.067	mg/kg dry	11/15/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	11/16/99	
Aroclor-1221	<0.1	mg/kg dry	11/16/99	
Aroclor-1232	<0.1	mg/kg dry	11/16/99	
Aroclor-1242	<0.1	mg/kg dry	11/16/99	
Aroclor-1248	<0.1	mg/kg dry	11/16/99	
Aroclor-1254	<0.1	mg/kg dry	11/16/99	
Aroclor-1260	<0.1	mg/kg dry	11/16/99	
EPA 8310 PAH				
Chrysene	<0.04	mg/kg dry	11/20/99	
Fluoranthene	0.21	mg/kg dry	11/20/99	
Phenanthrene	<0.1	mg/kg dry	11/20/99	
Pyrene	<0.1	mg/kg dry	11/20/99	
Benzo(a)anthracene	0.25	mg/kg dry	11/20/99	

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Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: M-2 CRAYFISH
Project No.:
Source:
LSL Sample ID: 9908636-005
Sample Matrix: SHW, Dry Wt.

Authorization:
LSL Project No.: 9908636
Date Sampled: 10/13/99
Report Date: 11/29/99

Analytical Method Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	38	%	11/11/99	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<0.3	mg/kg dry	11/12/99	
Cadmium	<0.3	mg/kg dry	11/12/99	
Chromium	0.35	mg/kg dry	11/12/99	
Copper	43	mg/kg dry	11/12/99	
Lead	<0.3	mg/kg dry	11/12/99	
Nickel	0.45	mg/kg dry	11/12/99	
Titanium	<2	mg/kg dry	11/12/99	
Selenium	14	mg/kg dry	11/12/99	
Zinc	42	mg/kg dry	11/12/99	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.04	mg/kg dry	11/15/99	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	11/16/99	
Aroclor-1221	<0.1	mg/kg dry	11/16/99	
Aroclor-1232	<0.1	mg/kg dry	11/16/99	
Aroclor-1242	<0.1	mg/kg dry	11/16/99	
Aroclor-1248	<0.1	mg/kg dry	11/16/99	
Aroclor-1254	<0.1	mg/kg dry	11/16/99	
Aroclor-1260	<0.1	mg/kg dry	11/16/99	
EPA 8310 PAH				
Chrysene	<0.04	mg/kg dry	11/20/99	
Fluoranthene	0.15	mg/kg dry	11/20/99	
Phenanthrene	<0.1	mg/kg dry	11/20/99	
Pyrene	0.31	mg/kg dry	11/20/99	
Benzo(a)anthracene	0.30	mg/kg dry	11/20/99	

Life Science Laboratories, Inc.
5854 Butternut Drive, East Syracuse, New York 13057 Telephone: (315) 445-1105 Telefax: (315) 445-1301
NYS DOH ELAP No. 10248

Tissue Analysis - 2000

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
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N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-2 Fish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-002
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/12/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	26	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<3	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	0.45	mg/kg dry	10/31/00	
Copper	4.0	mg/kg dry	10/31/00	
Lead	3.1	mg/kg dry	10/31/00	
Nickel	<0.4	mg/kg dry	10/31/00	
Selenium	<5	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Titanium	0.88	mg/kg dry	10/31/00	
Zinc	110	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	0.23	mg/kg dry	10/30/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	10/30/00	
Aroclor-1221	<0.1	mg/kg dry	10/30/00	
Aroclor-1232	<0.1	mg/kg dry	10/30/00	
Aroclor-1242	<0.1	mg/kg dry	10/30/00	
Aroclor-1248	<0.1	mg/kg dry	10/30/00	
Aroclor-1254	<0.1	mg/kg dry	10/30/00	
Aroclor-1260	<0.1	mg/kg dry	10/30/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	<0.15	mg/kg dry	10/31/00	
Phenanthrene	<0.13	mg/kg dry	10/31/00	
Pyrene	0.46	mg/kg dry	10/31/00	
Benzo(a)anthracene	<0.07	mg/kg dry	10/31/00	

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NYS DOH ELAP No. 10248

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C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-4 Fish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-005
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/13/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	22	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<1	mg/kg dry	10/31/00	
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	0.61	mg/kg dry	10/31/00	
Copper	6.1	mg/kg dry	10/31/00	
Lead	0.82	mg/kg dry	10/31/00	
Nickel	<0.4	mg/kg dry	10/31/00	
Selenium	<6	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Titanium	2.6	mg/kg dry	10/31/00	
Zinc	180	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	0.39	mg/kg dry	10/30/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	10/30/00	
Aroclor-1221	<0.1	mg/kg dry	10/30/00	
Aroclor-1232	<0.1	mg/kg dry	10/30/00	
Aroclor-1242	<0.1	mg/kg dry	10/30/00	
Aroclor-1248	<0.1	mg/kg dry	10/30/00	
Aroclor-1254	<0.1	mg/kg dry	10/30/00	
Aroclor-1260	1.1	mg/kg dry	10/30/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	2.1	mg/kg dry	10/31/00	
Phenanthrene	<0.13	mg/kg dry	10/31/00	
Pyrene	<0.13	mg/kg dry	10/31/00	
Benzo(a)anthracene	<0.07	mg/kg dry	10/31/00	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
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N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: M-1 Fish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-006
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/12/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	23	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<1	mg/kg dry	10/31/00	
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	0.48	mg/kg dry	10/31/00	
Copper	6.0	mg/kg dry	10/31/00	
Lead	0.43	mg/kg dry	10/31/00	
Nickel	<0.4	mg/kg dry	10/31/00	
Selenium	<5	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Titanium	<0.4	mg/kg dry	10/31/00	
Zinc	150	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	0.17	mg/kg dry	10/30/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	10/31/00	
Aroclor-1221	<0.1	mg/kg dry	10/31/00	
Aroclor-1232	<0.1	mg/kg dry	10/31/00	
Aroclor-1242	<0.1	mg/kg dry	10/31/00	
Aroclor-1248	<0.1	mg/kg dry	10/31/00	
Aroclor-1254	<0.1	mg/kg dry	10/31/00	
Aroclor-1260	<0.1	mg/kg dry	10/31/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	<0.15	mg/kg dry	10/31/00	
Phenanthrene	0.78	mg/kg dry	10/31/00	
Pyrene	0.17	mg/kg dry	10/31/00	
Benzo(a)anthracene	1.6	mg/kg dry	10/31/00	

5854 Butternut Drive, East Syracuse, New York 13057 Telephone: (315) 445-1105 Telefax: (315) 445-1301
NYS DOH ELAP No. 10248

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: M-2 Fish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-007
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/12/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	22	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<1	mg/kg dry	10/31/00	
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	<0.4	mg/kg dry	10/31/00	
Copper	6.9	mg/kg dry	10/31/00	
Lead	<0.4	mg/kg dry	10/31/00	
Nickel	0.49	mg/kg dry	10/31/00	
Selenium	<6	mg/kg dry	10/31/00	(6)
(6) *Elevated detection limit due to matrix interference.*				
Titanium	0.58	mg/kg dry	10/31/00	
Zinc	100	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	0.23	mg/kg dry	10/30/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	10/31/00	
Aroclor-1221	<0.1	mg/kg dry	10/31/00	
Aroclor-1232	<0.1	mg/kg dry	10/31/00	
Aroclor-1242	<0.1	mg/kg dry	10/31/00	
Aroclor-1248	<0.1	mg/kg dry	10/31/00	
Aroclor-1254	<0.1	mg/kg dry	10/31/00	
Aroclor-1260	<0.1	mg/kg dry	10/31/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	<0.15	mg/kg dry	10/31/00	
Phenanthrene	<0.13	mg/kg dry	10/31/00	
Pyrene	<0.13	mg/kg dry	10/31/00	
Benzo(a)anthracene	<0.07	mg/kg dry	10/31/00	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: BT-US Fish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-008
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/11/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	19	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<2	mg/kg dry	10/31/00	
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	1.0	mg/kg dry	10/31/00	
Copper	17	mg/kg dry	10/31/00	
Lead	3.0	mg/kg dry	10/31/00	
Nickel	0.68	mg/kg dry	10/31/00	
Selenium	<7	mg/kg dry	10/31/00	
Titanium	5.0	mg/kg dry	10/31/00	
Zinc	210	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.07	mg/kg dry	10/29/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	10/31/00	
Aroclor-1221	<0.1	mg/kg dry	10/31/00	
Aroclor-1232	<0.1	mg/kg dry	10/31/00	
Aroclor-1242	<0.1	mg/kg dry	10/31/00	
Aroclor-1248	<0.1	mg/kg dry	10/31/00	
Aroclor-1254	<0.1	mg/kg dry	10/31/00	
Aroclor-1260	<0.1	mg/kg dry	10/31/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	<0.15	mg/kg dry	10/31/00	
Phenanthrene	<0.13	mg/kg dry	10/31/00	
Pyrene	<0.13	mg/kg dry	10/31/00	
Benzo(a)anthracene	<0.07	mg/kg dry	10/31/00	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-2 Crayfish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-001
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/13/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	27	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<3	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	0.51	mg/kg dry	10/31/00	
Copper	130	mg/kg dry	10/31/00	
Lead	5.8	mg/kg dry	10/31/00	
Nickel	0.70	mg/kg dry	10/31/00	
Selenium	<4	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Titanium	1.8	mg/kg dry	10/31/00	
Zinc	68	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	0.45	mg/kg dry	1/29/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	10/30/00	
Aroclor-1221	<0.1	mg/kg dry	10/30/00	
Aroclor-1232	<0.1	mg/kg dry	10/30/00	
Aroclor-1242	<0.1	mg/kg dry	10/30/00	
Aroclor-1248	<0.1	mg/kg dry	10/30/00	
Aroclor-1254	<0.1	mg/kg dry	10/30/00	
Aroclor-1260	<0.1	mg/kg dry	10/30/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	<0.15	mg/kg dry	10/31/00	
Phenanthrene	<0.13	mg/kg dry	10/31/00	
Pyrene	<0.13	mg/kg dry	10/31/00	
Benzo(a)anthracene	<0.07	mg/kg dry	10/31/00	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-3 Crayfish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-003
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/13/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	25	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<3	mg/kg dry	10/31/00	
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	1.2	mg/kg dry	10/31/00	
Copper	170	mg/kg dry	10/31/00	
Lead	2.1	mg/kg dry	10/31/00	
Nickel	1.2	mg/kg dry	10/31/00	
Selenium	<5	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Titanium	5.6	mg/kg dry	10/31/00	
Zinc	110	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.07	mg/kg dry	10/29/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	10/30/00	
Aroclor-1221	<0.1	mg/kg dry	10/30/00	
Aroclor-1232	<0.1	mg/kg dry	10/30/00	
Aroclor-1242	<0.1	mg/kg dry	10/30/00	
Aroclor-1248	<0.1	mg/kg dry	10/30/00	
Aroclor-1254	<0.1	mg/kg dry	10/30/00	
Aroclor-1260	<0.1	mg/kg dry	10/30/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	<0.15	mg/kg dry	10/31/00	
Phenanthrene	<0.13	mg/kg dry	10/31/00	
Pyrene	<0.13	mg/kg dry	10/31/00	
Benzo(a)anthracene	0.073	mg/kg dry	10/31/00	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: L-4 Crayfish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-004
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/13/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	23	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<4	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	1.3	mg/kg dry	10/31/00	
Copper	190	mg/kg dry	10/31/00	
Lead	3.5	mg/kg dry	10/31/00	
Nickel	1.2	mg/kg dry	10/31/00	
Selenium	<6	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Titanium	5.2	mg/kg dry	10/31/00	
Zinc	100	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.06	mg/kg dry	10/29/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	10/30/00	
Aroclor-1221	<0.1	mg/kg dry	10/30/00	
Aroclor-1232	<0.1	mg/kg dry	10/30/00	
Aroclor-1242	<0.1	mg/kg dry	10/30/00	
Aroclor-1248	<0.1	mg/kg dry	10/30/00	
Aroclor-1254	<0.1	mg/kg dry	10/30/00	
Aroclor-1260	<0.1	mg/kg dry	10/30/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	1.9	mg/kg dry	10/31/00	
Phenanthrene	<0.13	mg/kg dry	10/31/00	
Pyrene	<0.13	mg/kg dry	10/31/00	
Benzo(a)anthracene	0.071	mg/kg dry	10/31/00	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: BT-US Crayfish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-009
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/11/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	23	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<4	mg/kg dry	10/31/00	
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	1.8	mg/kg dry	10/31/00	
Copper	130	mg/kg dry	10/31/00	
Lead	5.5	mg/kg dry	10/31/00	
Nickel	1.6	mg/kg dry	10/31/00	
Selenium	<6	mg/kg dry	10/31/00	
Titanium	11	mg/kg dry	10/31/00	
Zinc	92	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.08	mg/kg dry	10/29/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Arocior-1016	<0.1	mg/kg dry	10/31/00	
Arocior-1221	<0.1	mg/kg dry	10/31/00	
Aroclor-1232	<0.1	mg/kg dry	10/31/00	
Aroclor-1242	<0.1	mg/kg dry	10/31/00	
Aroclor-1248	<0.1	mg/kg dry	10/31/00	
Aroclor-1254	<0.1	mg/kg dry	10/31/00	
Aroclor-1260	<0.1	mg/kg dry	10/31/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	<0.15	mg/kg dry	10/31/00	
Phenanthrene	<0.13	mg/kg dry	10/31/00	
Pyrene	<0.13	mg/kg dry	10/31/00	
Benzo(a)anthracene	<0.07	mg/kg dry	10/31/00	

-- LABORATORY ANALYSIS REPORT --

C&S Engineers, Inc.
1099 Airport Blvd.
N. Syracuse, NY 13212

Attn: Bryan Bayer
Phone: (315) 455-2000
FAX: (315) 455-9667

Sample ID: BT-DS Crayfish - Composite

Project No.: CAS-2039
Source:
LSL Sample ID: 0009271-010
Sample Matrix: SHW,Dry Wt.

Authorization:
LSL Project No.: 0009271
Date Sampled: 10/12/00
Report Date: 11/13/00

Parameter(s)	Results	Units	Analysis Date	Comment
EPA 160.3 Total Solids				
Total Solids @ 103-105 C	26	%	10/26/00	
EPA 6010 Priority Poll. Metals (Dry Wt.)				
Arsenic	<4	mg/kg dry	10/31/00	(6)
(6) Elevated detection limit due to matrix interference.				
Cadmium	<0.4	mg/kg dry	10/31/00	
Chromium	2.0	mg/kg dry	10/31/00	
Copper	150	mg/kg dry	10/31/00	
Lead	31	mg/kg dry	10/31/00	
Nickel	1.9	mg/kg dry	10/31/00	
Selenium	<1	mg/kg dry	10/31/00	
Titanium	5.5	mg/kg dry	10/31/00	
Zinc	100	mg/kg dry	10/31/00	
EPA 7471 Mercury (Dry Weight)				
Mercury	<0.06	mg/kg dry	10/29/00	
EPA 8082 PCB's (Reported as Dry Weight)				
Aroclor-1016	<0.1	mg/kg dry	10/31/00	
Aroclor-1221	<0.1	mg/kg dry	10/31/00	
Aroclor-1232	<0.1	mg/kg dry	10/31/00	
Aroclor-1242	<0.1	mg/kg dry	10/31/00	
Aroclor-1248	<0.1	mg/kg dry	10/31/00	
Aroclor-1254	<0.1	mg/kg dry	10/31/00	
Aroclor-1260	<0.1	mg/kg dry	10/31/00	
EPA 8310 PAH (Dry Wt.)				
Chrysene	<0.04	mg/kg dry	10/31/00	
Fluoranthene	<0.15	mg/kg dry	10/31/00	
Phenanthrene	<0.13	mg/kg dry	10/31/00	
Pyrene	<0.13	mg/kg dry	10/31/00	
Benzo(a)anthracene	0.18	mg/kg dry	10/31/00	

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-3502

John P. Cahill
Acting Commissioner

TO: Tony Longo

FAX NUMBER: 315/455-9687

FROM: Robert Bode

DATE: 9 Dec 1998

NUMBER OF PAGES: cover + 1

For verification or problems, call 518 285-5682 or 285-5683

MESSAGE:

Tony - These are the recommended levels of concern that I have derived for minnows. Please note the disclaimer concerning wider usage of these values.

— Bob Bode

OUR RECEIVING FAX NUMBER IS 518 285-5601

Recommended provisional levels of concern for minnows, whole body, in ppm (mg/kg) dry weight*

Arsenic	4
Cadmium	2
Chromium	20
Copper	100
Lead	5
Mercury	1
Nickel	10
Selenium	4
Titanium	50
Zinc	200
Total PCBS	5

PAHs	
Chrysene	.040
Fluoranthene	.150
Phenanthrene	.130
Pyrene	.130
Benzo [A] Anthracene	.070

* For use with wet weight analysis, the above levels values should be divided by 5

These values are provided as guidance values for this study only; they are not intended to be used beyond this study, or as NYS DEC criteria. Metals values were derived from sample data collected by the Stream Biomonitoring Unit, and data from the literature. Where no data were available, invertebrate levels were used. For PAH levels, since insufficient fish data were available crayfish values were used as default guidance. The few fish data that were available indicated that these levels are reasonable approximations.

TABLE 1
OUTFALL TRIBUTARY AREAS

Outfall	Impervious Area (Acres)	Total Area (Acres)
001	42	172
002	34	142
003	123	340
004	66	191
005	135	414
006	82	143
007	0	2
008	3	3

Table 2

Potential Stormwater Quantities

Outfall	Stormwater Generated (gallons)
001	40,561,000
002	32,956,000
003	111,629,000
004	60,273,000
005	124,305,000
006	70,762,000
007	87,000
Total	**440,573,000**

Table 3

Stream Physical and Chemical Measurements

SAMPLING LOCATION	TEST	October 1998	Feb-99	May 1999	August 1999	October 1999	February 2000	May 2000	August 2000	October 2000
BT-US	Depth (ft.)	0.60	0.80	0.90	1.00	1.00	0.95	0.70	1.50	0.50
	Width (ft.)	7.0	-	6.0	2.5	7.0	5.0	3.3	12.0	5.0
	Current (ft/sec)	0.20	0.60	0.01	0.01	0.30	0.09	0.30	0.02	0.20
	pH	7.70	8.00	7.59	7.73	8.30	7.62	7.60	7.52	8.00
	Temp	11.0	2.0	19.3	16.2	12.0	1.6	18.9	17.0	12.0
	Conductivity	925	2400	1300	1300	700	2810	1390	1150	460
	DO	6.20	9.80	7.00	3.23	7.50	8.09	7.94	3.98	6.20
BT-DS	Depth (ft.)	0.80	1.00	0.80	0.90	1.40	0.75	0.60	0.50	1.30
	Width (ft.)	11.0	-	3.0	10.6	10.0	1.5	6.0	5.0	13.0
	Current (ft/sec)	1.50	1.90	0.48	0.22	0.90	1.71	1.63	0.51	<0.1
	pH	8.00	7.70	8.00	8.01	8.10	7.90	7.30	7.61	7.90
	Temp	12.0	3.0	18.6	19.6	12.0	2.9	16.1	17.7	10.0
	Conductivity	1400	3100	1500	1410	910	2610	1510	1370	1700
	DO	8.60	11.20	8.97	8.81	7.80	9.35	9.21	5.82	6.70
M-1	Depth (ft.)	0.40	0.50	0.30	0.40	0.30	0.58	0.65	0.35	0.30
	Width (ft.)	5.0	-	5.0	2.5	4.0	6.0	4.0	3.6	3.0
	Current (ft/sec)	0.70	1.30	0.17	0.21	0.70	0.40	1.47	0.36	0.30
	pH	7.80	7.60	6.90	7.38	8.00	7.61	7.70	7.73	8.00
	Temp	13.0	5.0	13.6	14.8	12.0	4.0	11.8	14.8	11.0
	Conductivity	813	2000	850	960	910	1020	853	861	970
	DO	7.20	8.80	10.01	5.84	9.10	8.03	8.42	5.17	9.50
M-2	Depth (ft.)	0.90	1.30	0.75	0.50	0.70	0.50	0.55	1.50	2.30
	Width (ft.)	12.0	-	9.0	2.5	12.0	10.0	5.5	6.0	Flooded
	Current (ft/sec)	0.10	0.50	0.28	0.08	0.20	0.57	1.30	0.15	0.50
	pH	7.80	8.00	7.15	7.55	8.20	7.21	7.70	7.70	7.90
	Temp	14.0	2.0	14.1	16.0	13.0	1.2	12.2	16.7	8.0
	Conductivity	900	1800	950	980	840	1190	910	867	1050
	DO	6.60	9.60	7.76	5.28	7.40	7.96	8.12	5.96	7.40
L-1	Depth (ft.)	2.50	>2.0	2.30	2.20	0.70	2.00	3.20	2.30	0.70
	Width (ft.)	25.0	-	16.0	16.0	25.0	12.0	16.0	16.0	25.0
	Current (ft/sec)	<0.1	<0.1	0.05	0.03	<0.1	0.09	0.08	0.02	<0.1
	pH	7.80	8.00	7.43	6.10	8.00	7.04	7.30	7.61	7.80
	Temp	11.0	0.0	15.6	15.1	15.0	0.1	13.6	20.6	8.0
	Conductivity	1400	1200	1300	830	1900	1620	980	1400	1700
	DO	5.90	7.80	3.82	6.72	7.20	5.52	11.57	4.14	7.70
L-2	Depth (ft.)	1.00	2.00	1.10	0.60	1.10	1.00	1.10	0.60	0.60
	Width (ft.)	25.0	-	10.0	4.0	10.0	5.0	9.0	3.0	5.0
	Current (ft/sec)	<0.1	0.80	0.15	0.11	1.00	0.42	0.66	0.19	0.40
	pH	7.80	8.00	7.48	7.48	8.20	6.43	7.10	7.75	8.00
	Temp	12.0	0.0	16.8	20.8	9.0	0.1	13.5	21.5	11.0
	Conductivity	1200	1100	1110	1070	1350	1380	901	1030	1450
	DO	6.60	9.50	6.20	7.81	8.20	7.60	7.38	5.56	10.50
L-3	Depth (ft.)	0.50	1.30	0.60	0.25	0.70	0.40	0.70	0.50	0.60
	Width (ft.)	10.0	-	6.0	4.0	10.0	8.0	9.0	7.5	13.0
	Current (ft/sec)	0.70	1.50	1.65	0.62	0.40	0.62	2.04	0.52	0.50
	pH	7.80	7.80	7.57	7.37	7.60	6.84	7.70	7.77	7.70
	Temp	11.0	0.0	15.5	18.0	13.0	0.4	13.3	19.1	11.0
	Conductivity	1200	1200	1050	2280	1600	1750	957	1220	1400
	DO	7.20	10.50	7.72	6.28	9.10	7.95	11.59	5.22	8.40
L-4	Depth (ft.)	0.70	1.50	0.50	0.25	1.00	0.40	0.70	0.53	0.60
	Width (ft.)	10.0	-	13.0	3.0	10.0	11.0	5.0	3.0	13.0
	Current (ft/sec)	2.30	3.00	0.66	0.84	2.50	1.05	1.40	1.40	0.90
	pH	7.80	7.60	7.59	7.64	8.20	6.15	7.50	7.91	8.00
	Temp	12.0	2.0	15.8	18.1	12.0	1.1	13.8	19.6	10.0
	Conductivity	850	1300	1130	1150	710	1850	990	1050	1200
	DO	8.90	10.80	8.45	5.63	9.30	9.40	11.96	5.13	8.80

Table 4

Percent composition of microinvertebrate taxa collected from North Branch Ley Creek (L), Onondaga County, New York October 14-16, 1998 and October 13-15, 1999 and October 11-13, 2000

TAXA	Sample Locations (Percent Occurrence)											
	L-1			L-2			L-3			L-4		
	1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Platyhelminthes												
Turbellaria												
cf. *Dugesia* sp.	<1		<1		1	2	<1	<1		<1	4	1
Annelida												
Oligochaeta												
Undet. Tubificidae	4	19	20	2	28	<1	27	11	3	1	11	
Hirudinea												
Helobdella stagnalis								<1	<1			
Undet. Hirudinea	<1		<1	<1		2	5	1	3	2	<1	
Mollusca												
Gastropoda												
Gyraulus sp.							<1					
Lymnaea humilis		3										
Physa sp.	1	<1	<1	<1		<1	<1	2	4	<1	<1	
Undet. Ancylidae	<1		1				<1		1	1	<1	
Undet. Lymnaeidea						<1						
Undet. Planorbidae		4	<1						<1			
Undet. Valvatidae												
Pelecypoda												
Undet. Sphaeriidae	<1						6	3	10	8	12	4
Arthropoda												
Crustacea												
Isopoda												
Caecidotea sp.	4	<1	7	3	3	16	3	25	19	17	39	26
Amphipoda												
Gammarus sp.	16	<1	18	21	2	36	32	24	15	46	13	10
Hyalella azteca					<1							

Table 4 (page 2 of 4)

TAXA	Sample Locations (Percent Occurrence)											
	L-1			L-2			L-3			L-4		
	1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Insecta												
Ephemeroptera												
Baetidae												
Callibaetis sp.	1		10									
Undet. Baetidae			1		5	1				<1		
Caenidae												
Caenis sp.					<1							
Siphlonuridae												
Siphlonurus sp.				2								
Undet. Ephemeroptera												
Odonata												
Anisoptera												
Aeshnidae												
Anax sp.				<1								
Gomphidae												
Arigomphus sp.												
Libellulidae												
Libellula sp.					<1							
Zygoptera												
Calopterygidae												
Calopteryx sp.								<1				
Coenagrionidae												
Enallagma sp.	4		3	4	5	4	1	2	1	<1		
Hemiptera												
Belostomatidae												
Belostoma sp.	<1		<1	1								
Corixidae												
Undet. Corixidae	53	3	12	5	3	1		1				
Nepidae												
Ranatra sp.				<1								
Notonectidae												
Notonecta sp.	<1											

Table 4 (page 3 of 4)

TAXA	Sample Locations (Percent Occurrence)											
	L-1			L-2			L-3			L-4		
	1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Trichoptera												
Hydropsychidae												
Cheumatopsyche sp.						2	<1	4		7	10	6
Diplectrona sp.												
Hydropsyche sp.							1	<1	2	6	2	3
Undet. Hydropsychidae				<1						1	<1	<1
Philopotamidae												
cf. *Dolophilodes* sp.				<1								
Phryganeidae												
Ptilostomis sp.												
Undet. Phryganeidae		<1										
Coleoptera												
Dytiscidae												
Agabus sp.												
Undet. Dytiscidae			<1									
Elmidae												
Dubiraphia sp.	1		<1	9	7	1		<1	2			
Gyrinidae												
cf. *Gyrinus* sp.												
Haliplidae												
Haliplus sp.			<1	<1								
Hydrophilidae												
Undet. Hydrophilidae												
Diptera												
Ceratopogonidae												
Undet. Ceratopogonidae	1	11		1	2			<1				
Chironomidae												
Undet. Chironomidae	15	55	25	50	41	32	22	22	36	9	6	46
Dolichopodidae												
Undet. Dolichopodidae		2										
Empididae												
Hemerodromia sp.						<1			<1			<1
Ptychopteridae												
cf. *Ptychoptera* sp.												

Table 4 (page 4 of 4)

TAXA	Sample Locations (Percent Occurrence)											
	L-1			L-2			L-3			L-4		
	1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Simuliidae												
Simulium sp.						<1						
Undet. Simuliidae						<1					<1	<1
Stratiomyidae												
Undet. Stratiomyidae												
Tabanidae												
Undet. Tabanidae					<1							
Tipulidae												
Tipula sp.	<1							<1	1	1	1	2
Undet. Tipulidae		<1			<1							
Undet. Diptera		2							<1			

Table 5

Percent composition of macroinvertebrate taxa collected from Mud Creek (M) and Beartrap Creek (BT), Onondaga County, New York, October 14-16, 1998 and October 13-15, 1999, and October 11-13, 2000

TAXA	Sample Locations (Percent Occurrence)											
	M-1			M-2			BT-US			BT-DS		
	1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Platyhelminthes												
Turbellaria												
cf. *Dugesia* sp.			<1				7	27	2	1	16	1
Annelida												
Oligochaeta												
Undet. Tubificidae	3	5	4	4	1	1	2	16	6	9	18	1
Hirudinea												
Helobdella stagnalis						<1		<1	2		<1	
Undet. Hirudinea	<1	<1	<1					<1		<1		1
Mollusca												
Gastropoda												
Gyraulus sp.												
Lymnaea humilis												
Physa sp.	2	14	6		<1		<1				1	
Undet. Ancylidae					<1							
Undet. Lymnaeidae									<1		<1	
Undet. Planorbidae		<1										
Undet. Valvatidae									<1			
Pelecypoda						<1						
Undet. Sphaeriidae	<1	3	4				3	3	1	1	1	1
Arthropoda												
Crustacea												
Isopoda												
Caecidotea sp.	9	40	11	<1	<1	1	18	19	33	4	20	16
Amphipoda												
Gammarus sp.	80	29	66	1	4	<1	56	6	4	27	7	9
Hyalella azteca									<1		<1	2

Table 5 (page 2 of 4)

TAXA	Sample Locations (Percent Occurrence)											
	M-1			M-2			BT-US			BT-DS		
	1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Insecta												
Ephemeroptera												
Baetidae												
Callibaetis sp.												
Undet. Baetidae		<1	1		<1						<1	
Caenidae												
Caenis sp.												
Siphlonuridea												
Siphlonurus sp.												
Undet. Ephemeroptera				<1								
Ondonta												
Anisoptera												
Aeshnidae												
Anax sp.												
Gomphidae												
Arigomphus sp.					<1							
Libellulidae												
Libellula sp.					<1							
Zygoptera												
Calopterygidae												
Calopteryx sp.					<1							<1
Coenagrionidae												
Enallagma sp.		<1			1						<1	<1
Hemiptera												
Belostomatidae												
Belostoma sp.		<1										
Corixidae												
Undet. Corixidae				<1	10	14	2		1	1		
Nepidae												
Ranatra sp.												
Notonectidae												
Notonecta sp.												

Table 5 (page 3 of 4)

TAXA	(Percent Occurrence)											
	M-1			M-2			BT-US			BT-DS		
	1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Trichoptera												
Hydropsychidae												
Cheumatopsyche sp.					<1					11	1	10
Diplectrona sp.	<1											
Hydropsyche sp.	<1	<1	3							1	<1	4
Undet. Hydropsychidae										1		1
Philopotamidae												
cf. Dolophilodes sp.			<1									
Phryganeidae												
Ptilostomis sp.	<1											
Undet. Phryganeidae												
Coleoptera												
Dytiscidae												
Agabus sp.	<1				<1							<1
Undet. Dytiscidae												
Elmidae												
Dubiraphia sp.				<1	<1	<1						
Gyrinidae												
cf. Gyrinus sp.								<1				
Haliplidae												
Haliplus sp.										<1		
Hydrophilidae												
Undet. Hydrophilidae			<1									
Diptera												
Ceratopogonidae												
Undet. Ceratopogonidae	<1			<1	<1	<1		<1			<1	
Chironomidae												
Undet. Chironomidae	4	6	4	93	80	82	12	26	50	41	32	48
Dolichopodidae												
Undet. Dolichopodidae								<1				
Empididae												
Hemerodromia sp.										2	1	3
Ptychopteridae												
cf. *Ptychoptera* sp.								<1				

Table 5 (page 4 of 4)

TAXA	Sample Locations (Percent Occurrence)											
	M-1			M-2			BT-US			BT-DS		
	1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Simuliidae												
Simulium sp.												
Undet. Simuliidae	<1									<1		<1
Stratiomyidae												
Undet. Stratiomyidae		<1						<1				
Tabanidae												
Undet Tabanidae												
Tipulidae												
Tipula sp.												<1
Undet Tipulidae								<1				
Undet. Diptera												

Table 6

Macroinvertebrate community indices from locations on North Branch Ley Creek, Mud Creek, and Beartrap Creek, Onondaga County, New York, October 14-16, 1998

Ley Creek

Locations	L-1			L-2			L-3			L-4		
Sample	A	B	C	A	B	C	A	B	C	A	B	C
Index: [1]												
SPP	14 (3.9)	9 (0.7)	9 (0.7)	11 (2.1)	9 (0.7)	11 (2.1)	8 (0.0)	13 (3.4)	6 (0.0)	10 (2.3)	9 (1.8)	11 (2.8)
EPT	1 (1.5)	0 (0.0)	1 (1.5)	3 (4.5)	0 (0.0)	1 (1.5)	0 (0.0)	2 (3.1)	0 (0.0)	2 (3.1)	1 (1.3)	2 (3.1)
HBI	5.7 (7.2)	5.9 (6.8)	5.4 (7.7)	5.5 (7.5)	5.6 (7.3)	5.8 (7.0)	6.4 (6.0)	6.2 (5.4)	8.4 (2.7)	6.0 (5.6)	6.4 (5.1)	5.8 (5.9)
NCO[2]	12 (8.5)	7 (5.9)	7 (5.9)	9 (6.8)	7 (5.9)	10 (7.3)	6 (5.5)	-	4 (4.2)	-	-	-
PMA[2]	-	-	-	-	-	-	-	27 (1.2)	-	30 (1.7)	16 (0.0)	40 (3.5)
WQS[3]	4.2			4.4			2.6			3.0		

Mud Creek (M) and Beartrap Creek (BT)

Locations	M-1			M-2			BT-US			BT-DS		
Sample	A	B	C	A	B	C	A	B	C	A	B	C
Index: [1]												
SPP	11 (2.8)	7 (0.9)	8 (1.4)	5 (0.0)	4 (9.0)	5 (0.0)	7 (0.0)	7 (0.0)	6 (0.0)	9 (1.8)	9 (1.8)	9 (1.8)
EPT	3 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.1)	2 (1.3)	1 (1.3)
HBI	6.2 (5.4)	6.5 (5.0)	6.8 (4.6)	5.0 (8.3)	5.4 (7.7)	5.2 (8.0)	6.5 (5.8)	6.1 (6.5)	6.2 (6.3)	5.4 (6.4)	6.1 (5.5)	5.9 (5.8)
NCO[2]	-	-	-	4 (4.2)	2 (3.1)	3 (3.6)	5 (4.7)	5 (4.7)	4 (4.2)	-	-	-
PMA[2]	11 (0.0)	18 (0.0)	31 (1.9)	-	-	-	-	-	-	40 (3.5)	45 (4.3)	40 (3.5)
WQS[3]	2.1			3.0			2.7			3.5		

1 SSP (species richness), EPT (EPT richness), HBI (Hilsenhoff Biotic Index), NCO (NCO richness), PMA (Percent Model Affinity) – see text
Numbers in brackets () are the normalized equivalents for each index value, calculated using formulas supplied by Margaret A. Novak, Stream Biomonitoring Unit, NYS DEC, Albany, N.Y. Two sets of equations were used – one for samples from riffle habitats, the other for samples from slow, sandy/silty habitats.

2 NCO index calculated for samples from slow, sandy/silty locations, PMA calculated for samples from riffle areas.

3 WQS is mean of the indices (in brackets) which are normalized to a common scale of water quality that ranges from 0 for severely impacted to 10 for non-impacted.

Table 7

Macroinvertebrate community indices from locations on North Branch Ley Creek, Mud Creek, and Beartrap Creek, Onondaga County, New York, October 13-15, 1999

Ley Creek

Locations	L-1			L-2			L-3			L-4		
Sample	A	B	C	A	B	C	A	B	C	A	B	C
Index: [1]												
SPP	11 (2.1)	11 (2.1)	7 (0.0)	13 (3.4)	11 (2.1)	11 (2.1)	12 (3.0)	11 (2.8)	15 (4.3)	10 (2.3)	7 (0.9)	10 (2.3)
EPT	0 (0.0)	1 (1.5)	0 (0.0)	2 (3.5)	2 (3.5)	1 (1.5)	1 (1.5)	2 (3.1)	1 (1.5)	2 (3.1)	0 (0.0)	2 (3.1)
HBI	5.7 (7.2)	5.8 (7.0)	6.8 (5.3)	6.9 (5.2)	7.2 (4.7)	6.6 (5.7)	6.8 (5.3)	6.6 (4.9)	6.9 (5.2)	6.8 (4.6)	7.6 (3.6)	6.7 (4.8)
NCO[2]	9 (6.8)	9 (6.8)	5 (4.7)	11 (8.0)	9 (6.8)	9 (6.8)	10 (7.3)	-	13 (9.0)	-	-	-
PMA[2]	-	-	-	-	-	-	-	35 (2.7)	-	25 (0.9)	25 (0.9)	29 (1.6)
WQS[3]	3.6			4.4			4.2			2.3		

Mud Creek (M) and Beartrap Creek (BT)

Locations	M-1			M-2			BT-US			BT-DS		
Sample	A	B	C	A	B	C	A	B	C	A	B	C
Index: [1]												
SPP	11 (2.8)	8 (1.4)	8 (1.4)	11 (2.1)	7 (0.0)	9 (0.7)	10 (1.4)	7 (0.0)	10 (1.4)	9 (1.8)	9 (1.8)	12 (3.1)
EPT	1 (1.3)	0 (0.0)	1 (1.3)	2 (3.5)	0 (0.0)	1 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.1)	2 (3.1)
HBI	7.4 (3.9)	7.0 (3.9)	7.3 (4.0)	5.3 (7.8)	5.1 (8.2)	5.1 (8.2)	7.0 (5.0)	7.1 (4.8)	6.3 (6.2)	7.4 (3.9)	6.4 (5.1)	6.6 (4.9)
NCO[2]	-	-	-	9 (6.8)	5 (4.7)	8 (6.4)	8 (6.4)	5 (4.7)	8 (6.4)	-	-	-
PMA[2]	14 (0.0)	22 (0.3)	28 (1.4)	-	-	-	-	-	-	35 (2.7)	35 (2.7)	38 (3.2)
WQS[3]	1.8			4.2			3.0			2.9		

1 SSP (species richness), EPT (EPT richness), HBI (Hilsenhoff Biotic Index), NCO (NCO richness), PMA (Percent Model Affinity) – see text
Numbers in brackets () are the normalized equivalents for each index value, calculated using formulas supplied by Margaret A. Novak, Stream Biomonitoring Unit, NYS DEC, Albany, N.Y. Two sets of equations were used – one for samples from riffle habitats, the other for samples from slow, sandy/silty habitats.

2 NCO index calculated for samples from slow, sandy/silty locations, PMA calculated for samples from riffle areas.

3 WQS is mean of the indices (in brackets) which are normalized to a common scale of water quality that ranges from 0 for severely impacted to 10 for non-impacted.

Table 8

Macroinvertebrate community indices from locations on North Branch Ley Creek, Mud Creek, and Beartrap Creek, Onondaga County, New York, October 11-13, 2000

Ley Creek

Locations	L-1			L-2			L-3			L-4		
Sample	A	B	C	A	B	C	A	B	C	A	B	C
Index: [1]												
SPP	11 (2.1)	10 (1.4)	9 (0.7)	9 (0.7)	11 (2.1)	12 (3.0)	12 (3.0)	12 (3.1)	11 (2.1)	9 (1.8)	9 (1.8)	7 (0.9)
EPT	1 (1.5)	1 (1.5)	1 (1.5)	2 (3.5)	2 (3.5)	2 (3.5)	1 (1.5)	1 (1.3)	1 (1.5)	2 (3.1)	2 (3.1)	2 (3.1)
HBI	7.1 (4.9)	6.9 (5.1)	6.2 (6.3)	6.0 (6.7)	6.2 (6.4)	6.1 (6.5)	6.8 (5.4)	6.4 (5.2)	5.8 (7.0)	6.2 (5.3)	6.1 (5.5)	5.4 (5.3)
NCO[2]	9 (6.8)	8 (6.4)	7 (5.9)	8 (6.4)	10 (7.3)	10 (7.3)	10 (7.3)	-	9 (6.8)	-	-	-
PMA[2]	-	-	-	-	-	-	-	37 (3.0)	-	40 (3.5)	38 (3.2)	40 (3.5)
WQS[3]	3.7			4.7			3.9			3.4		

Mud Creek (M) and Beartrap Creek (BT)

Locations	M-1			M-2			BT-US			BT-DS		
Sample	A	B	C	A	B	C	A	B	C	A	B	C
Index: [1]												
SPP	11 (2.8)	6 (0.5)	8 (1.4)	5 (0.0)	5 (0.0)	6 (0.0)	10 (1.4)	7 (0.0)	7 (0.0)	12 (3.1)	13 (3.4)	12 (3.1)
EPT	3 (3.6)	0 (0.0)	1 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.1)	2 (3.1)	2 (3.1)
HBI	6.0 (5.6)	6.6 (4.9)	6.6 (4.9)	5.1 (8.1)	5.0 (8.2)	5.1 (8.1)	7.1 (4.9)	5.9 (6.9)	6.4 (6.1)	5.8 (5.9)	5.7 (6.0)	5.7 (6.0)
NCO[2]	-	-	-	3 (3.6)	3 (3.6)	5 (4.7)	8 (6.4)	5 (4.7)	5 (4.7)	-	-	-
PMA[2]	25 (0.9)	23 (0.5)	17 (0.0)	-	-	-	-	-	-	36 (2.8)	42 (3.8)	41 (3.6)
WQS[3]	2.2			3.0			2.9			3.9		

1 SSP (species richness), EPT (EPT richness), HBI (Hilsenhoff Biotic Index), NCO (NCO richness), PMA (Percent Model Affinity) – see text
Numbers in brackets () are the normalized equivalents for each index value, calculated using formulas supplied by Margaret A. Novak, Stream Biomonitoring Unit, NYS DEC, Albany, N.Y. Two sets of equations were used – one for samples from riffle habitats, the other for samples from slow, sandy/silty habitats.

2 NCO index calculated for samples from slow, sandy/silty locations, PMA calculated for samples from riffle areas.

3 WQS is mean of the indices (in brackets) which are normalized to a common scale of water quality that ranges from 0 for severely impacted to 10 for non-impacted.

Table 9

Locations and Types of Samples Collected for Tissue Analysis

Sampling Location	1998		1999		2000		No. of Samples
	Fish	Crayfish	Fish	Crayfish	Fish	Crayfish	
L-1	X	X[(a)]		X		X	4
L-2		X		X	X	X	4
L-3		X		X		X	3
L-4		X		X	X	X	4
M-1	X	X [(b)]	X		X		4
M-2		X		X	X		3
BT-US	X		X		X	X	4
BT-DS		X	X			X	3
No. of Samples	3	7	3	5	5	6	29

X=Sample Analyzed

(a) No PCB analysis done.
(b) No PCB or PAH analysis done.

Table 10

Sampling Locations[a] at Which Samples Exceeded Provisional Levels of Concern

COMPOUND	1998	1999	2000
Arsenic	(F) M-1 (C) L-1	(F) (C)	(F) (C)
Lead	(F) (C)	(F) (C)	(F) (C) L-2, BT-US, BT-DS
Nickel	(F) L-1 (C)	(F) (C)	(F) (C)
Selenium	(F) L-1, M-1, BT-US (C)	(F) M-1, BT-US, BT-DS (C) L-1, L-2, L-3, L-4, M-2	(F) (C)
Titanium	(F) (C) L-3	(F) (C)	(F) (C) BT-US
Zinc	(F) (C)	(F) BT-DS (C)	(F) BT-DS (C)
Mercury	(F) (C)	(F) (C)	(F) (C) L-2
Chrysene	(F) (C) L-2, L-3, M-2	(F) M-1 (C) L-2	(F) (C) L-1
Fluoranthene	(F) (C)	(F) BT-DS (C)L-2, L-3, L-4, M-2	(F) L-4 (C) L-4, L-1
Phenanthrene	(F) (C)	(F) M-1 (C)	(F) M-1 (C) L-1
Pyrene	(F) (C) L-2, L-3, L-4	(F) (C) L-2, M-2	(F) L-2, M-1 (C) L-1
Benzo(a)anthracene	(F) (C) L-1, L-2, L-3, L-4, BT-DS	(F) BT-DS (C) L-2, L-3, L-4, M-2	(F) M-1 (C) L-3, L-4, BT-DS,L-1

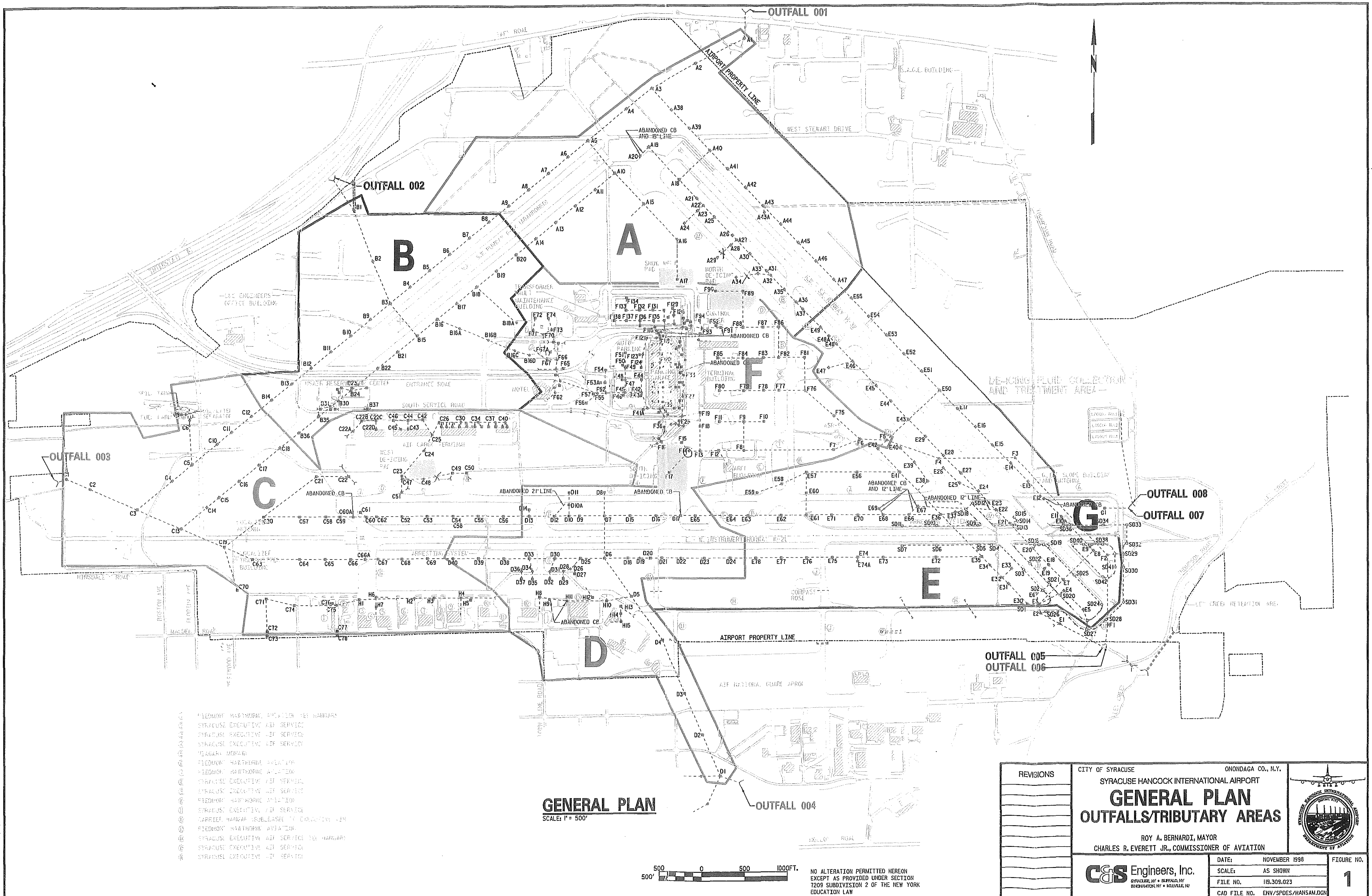
[a] See Figure 1 for Sampling Locations.

Table 11

Summary of Number of Samples with Results that Exceed Levels of Concern – Combined Years (1998, 1999, 2000) Data

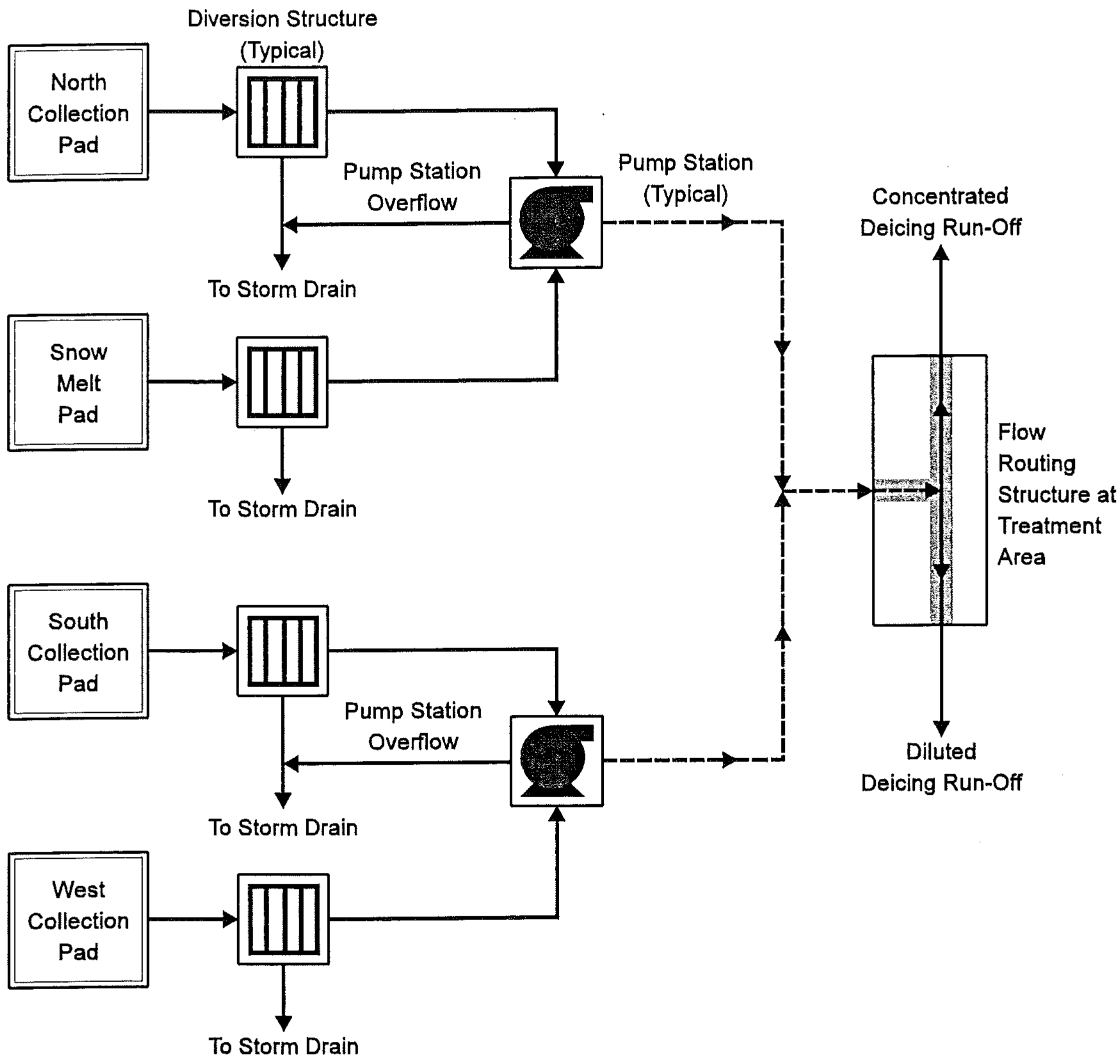
	FISH			CRAYFISH		
Sampling Location	**No. of Samples**	**No. of Metals**	**No. of PAHS**	**No. of Samples**	**No. of Metals**	**No. of PAHs**
L-1	1	2	0	3	2	6
L-2	1	0	1	3	3	7
L-3	-			3	2	6
L-4	1	0	1	3	1	6
M-1	3	3	5	1[a]	0	-
M-2	1	0	0	2	1	4
BT-US	3	3	0	1	2	0
BT-DS	1	2	2	2	1	2

(a) No PAH analysis done.



N:\DIVISION\ENV\SPDES\hansam.dgn

Figure 2



Diversion Structure (Typical)
North Collection Pad
Pump Station Overflow
Pump Station (Typical)
Concentrated Deicing Run-Off
To Storm Drain
Snow Melt Pad
To Storm Drain
Flow Routing Structure at Treatment Area
South Collection Pad
Pump Station Overflow
Diluted Deicing Run-Off
To Storm Drain
West Collection Pad
To Storm Drain

LEGEND

L-1 to L-4	- North Branch Ley Creek
M-1 and M-2	- Mud Creek
BT-US and BT-DS	- Beartrap Creek

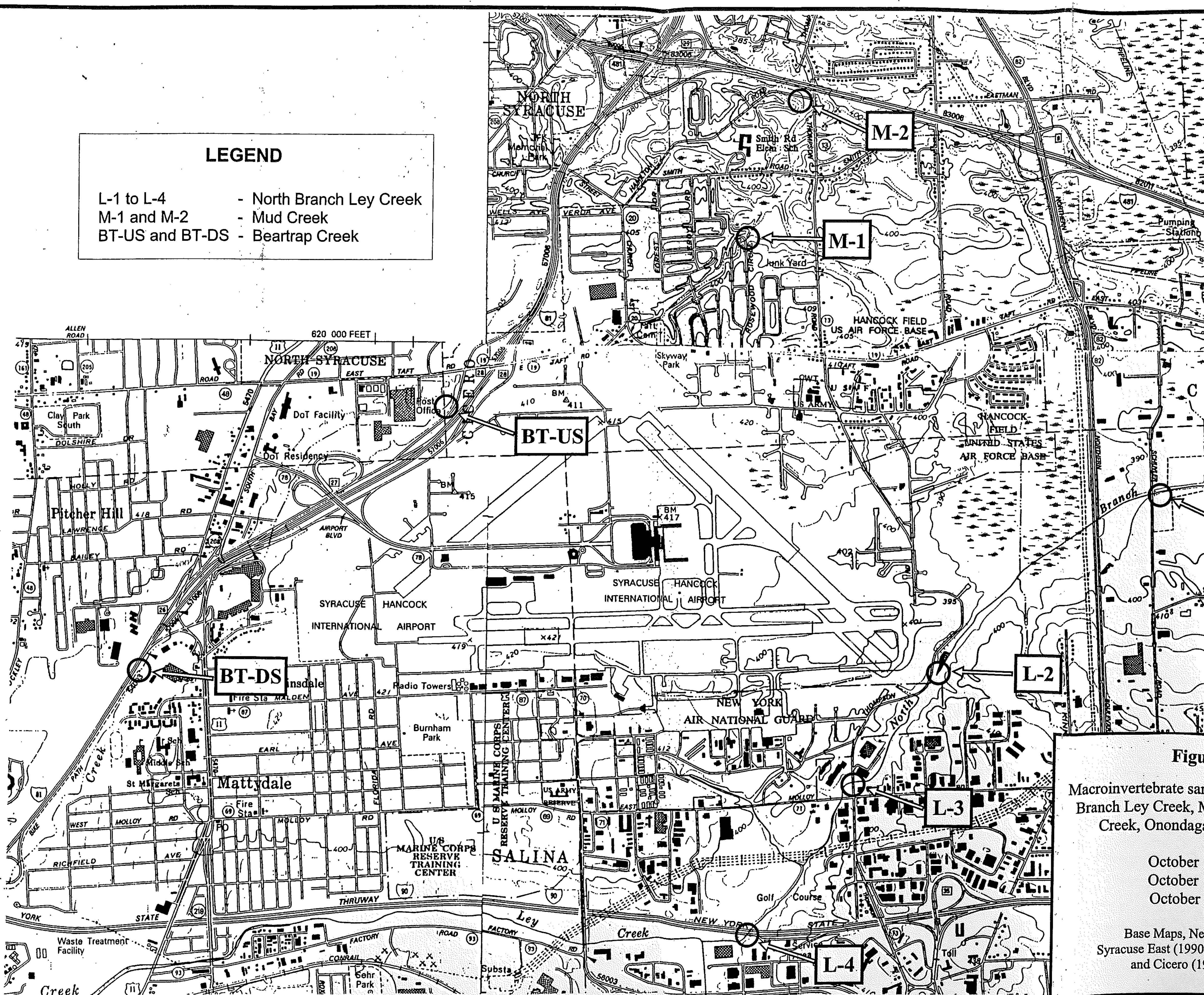


Figure 3

Macroinvertebrate sampling locations on North Branch Ley Creek, Mud Creek, and Beartrap Creek, Onondaga County, New York

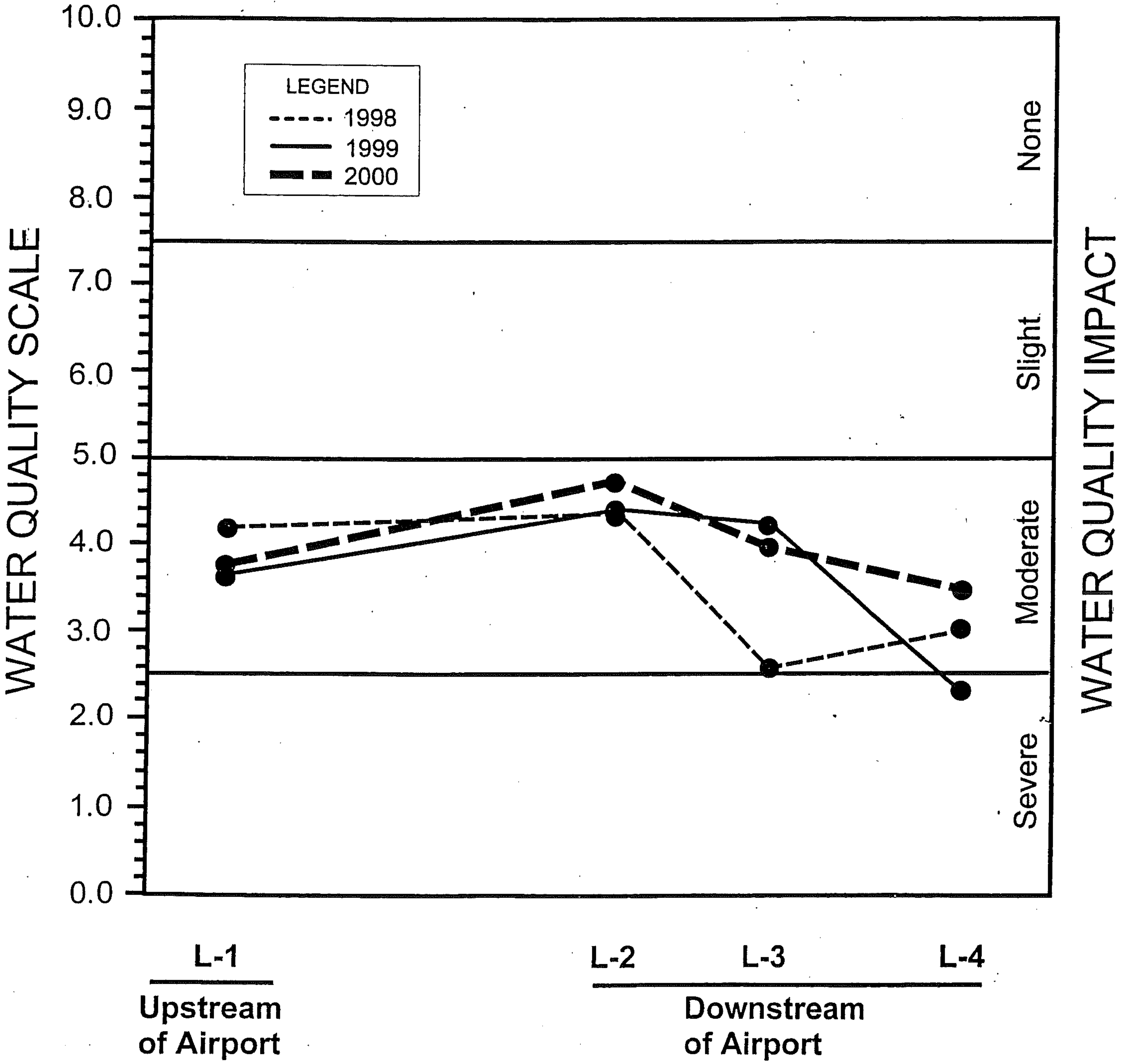
October 14-16, 1998,
October 13-15, 1999,
October 11-13, 2000

Base Maps, New York State DOT
Syracuse East (1990), Syracuse West (1990)
and Cicero (1989) Quadrangles

tes file: cas2039\2039map.dsf\11-27-2000

Figure 4

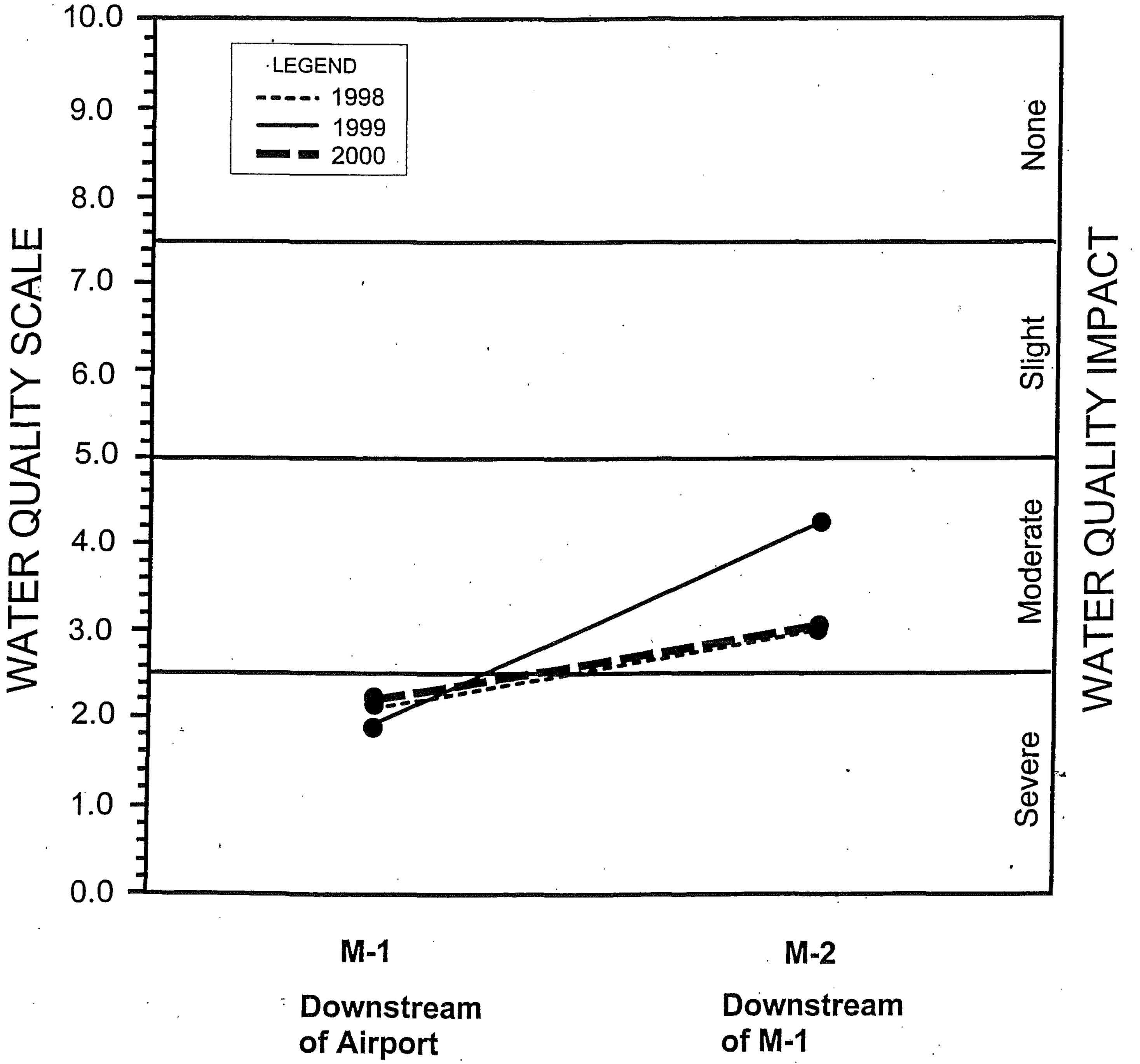
Biological Assessment Profile of index values. Macroinvertebrate samples from four locations on North Branch Ley Creek, October 15-16, 1998, October 13-15, 1999 and October 11-13, 2000. Each line connects the mean of 12 normalized values for each location, representing three each of SPP (species richness), EPT (EPT richness), HBI (Hilsenhoff Biotic Index) and either PMA (Percent Model Affinity) for riffle areas, or NCO (NCO richness) for slow, sandy areas.



tes file: cas-2039\ wqs2000.dsf

Figure 5

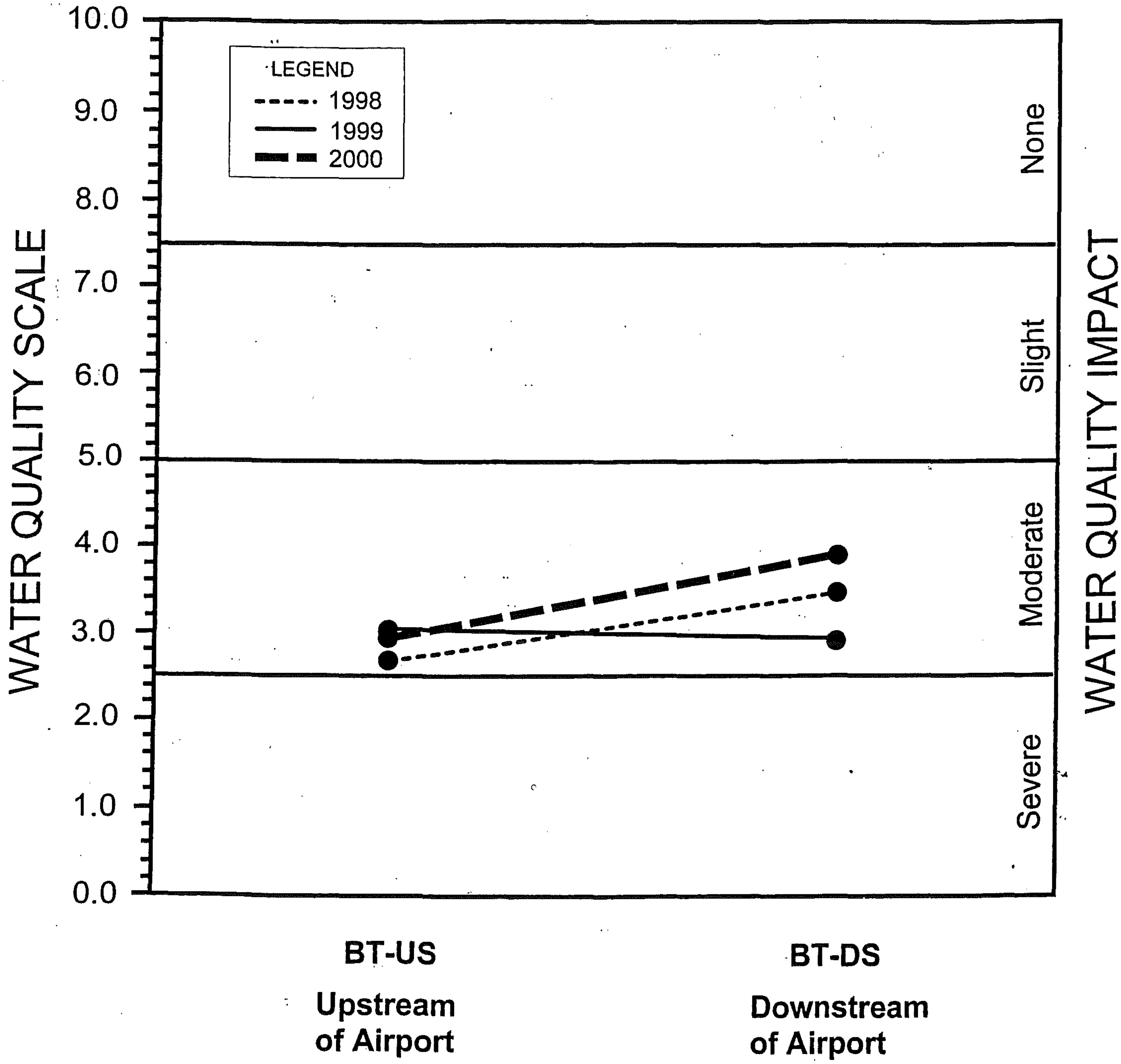
Biological Assessment Profile of index values. Macroinvertebrate samples from two locations on Mud Creek, October 14, 1998, October 13, 1999 and October 11, 2000. Each line connects the mean of 12 normalized values for each location, representing three each of SPP (species richness), EPT (EPT richness), HBI (Hilsenhoff Biotic Index) and either PMA (Percent Model Affinity) for riffle areas, or NCO (NCO richness) for slow, sandy areas.



tes file: cas-2039\ wqs2000.dsf

Figure 6

Biological Assessment Profile of index values. Macroinvertebrate samples from two locations on Beartrap Creek, October 15, 1998, October 14, 1999 and October 11-12, 2000. Each line connects the mean of 12 normalized values for each location, representing three each of SPP (species richness), EPT (EPT richness), HBI (Hilsenhoff Biotic Index) and either PMA (Percent Model Affinity) for riffle areas, or NCO (NCO richness) for slow, sandy areas.



tes file: cas-2039\ wqs2000.dsf